ATTACK OPERATIONS FOR MISSILE DEFENSE

by
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The Author

Lieutenant Colonel Merrick E. Krause was commissioned through the United States Air Force Academy in 1984. Graduating from Euro-NATO Undergraduate Pilot Training in 1985, he flew F-4Es as an aircraft commander and flight leader, at Moody AFB, Georgia, and at Seymour Johnson AFB, North Carolina. During the conversion of the first operational F-15E "Strike Eagle" Wing, Lieutenant Colonel Krause served as an F-15E instructor and evaluator pilot for the 4th Tactical Fighter Wing (TFW) at Seymour Johnson AFB. He was a mission commander during Operations DESERT SHIELD, DESERT STORM, and DESERT RESOLVE and was credited with 52 DESERT STORM combat sorties, accumulating well over 100 combat and combat support missions in the South West Asian theater. Krause is a USAF Fighter Weapons School graduate who served as a test project officer, Chief of Weapons, Strike Eagle Test Flight Commander, and as an instructor and evaluator pilot in the Air Warfare Center, at Nellis AFB, Nevada, until 1996. Lieutenant Colonel Krause served in the Pentagon Air Staff Checkmate Office as the Chief, Aerospace Campaign Strategy and Chief, CENTCOM/SOUTHCOM Team. Lieutenant Colonel Krause was distinguished graduate of the National War College Class of 2001 in Washington, D.C. He is currently Senior Military Fellow at the Institute for National Strategic Studies, National Defense University, where his portfolio includes future strategic concepts, coercion, deterrence, homeland security, military transformation, and aerospace strategy. Lieutenant Colonel Krause received his bachelor's degree in Behavioral Science from the U.S. Air Force Academy, a master's degree in Aeronautical Science from Embry-Riddle Aeronautical University, a master's degree in Air Power Arts and Sciences from the USAF School of Advanced Air Power Studies, and a master's degree in National Security Studies from the National War College. Lieutenant Colonel Krause is a command pilot with more than 2,800 flying hours and over 200 combat hours.

Preface

The two principal functions of ballistic missiles are to create fear and destroy targets. These weapons have historically spurred debates over the need to defend against ballistic missiles, especially when states can create terror with cheap and available missile technologies. Moreover, the proliferation of missile technologies contributes to the spread of missiles that may be armed with weapons of mass destruction.

The principal goal of this study is to promote attack operations as a critical first layer of missile defense. Attack operations are offensive actions whose aim is to destroy or render ineffective enemy missile systems, support structures on the ground, and enemy battlefield management and command and control systems. This study examines the approach that the United States Air Force should take toward missile defense in the near-term.[1] It focuses on broad strategic options, rather than specific tactical systems, notably the role of attack operations in the joint missile defense family of systems. Overall, this study recommends four options that the Air force should consider to emphasize attack operations in the near-term, in order to improve the ability of U.S. forces to destroy missiles, manage anti-access threats, and fill gaps in the present U.S. missile defense architecture.

The origins of this study began with the author's investigation into the long-term approach of the USAF toward theater missile defense while he was a student at the School of Advanced Airpower Studies, Maxwell Air Force Base. Earlier, the author participated as a mission commander on many "Scud Hunting" missions over Iraq, during Operation DESERT STORM, and later developed Attack Operations tactics in tests at Nellis AFB. The goal of this study is to promote further discussion about the role of the USAF in defeating the ballistic missile threat before an adversary attacks U.S. troops, allies, or the U.S. homeland with missiles.

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[1] For this study, "near-term" refers to period from the present to approximately 2005, "mid-term" covers the 2010 timeframe, and "long-term" is beyond 2010.

I. Introduction

The principal goal of this study is to promote attack operations as a critical first layer of missile defense. This is particularly true when planning to defeat anti-access and all missile threats.[1] To accomplish this goal, this study examines and compares several joint missile defense programs and proposes options for the United States Air Force to advance near-term missile defense and anti-access capabilities.

Attack operations are essentially offensive actions that seek to destroy or disrupt enemy missile systems and support structures.[2] Aircraft, Special Forces units, information operations, or uninhabited aerial vehicles (UAVs) can perform attack operations *today*. Though a joint capability, attack operations is one mission with which the Air Force has considerable experience, particularly in the realm of time-sensitive-targeting. Thus, while missile defense is truly a joint function, there are effective aerospace power options that dramatically increase joint missile defense capabilities.

The 1991 Persian Gulf War radically increased the importance of theater ballistic missiles in U.S. national security policy. Once regarded by many military leaders as a tactical nuisance, especially when armed with conventional high explosives, theater ballistic missiles suddenly became weapons of terror that could cause significant political and diplomatic problems. Although Iraq did not use weapons of mass destruction (WMD) in the 1991 war, when Iraq fired conventionally equipped Scud missiles against Israel, it created a political crisis for the coalition.[3] Moreover, a single conventionally armed Scud produced the greatest number of U.S. fatalities of any single event during Operation Desert Storm when it struck a barracks in Dhahran.

During the Gulf War, hundreds of sorties and thousands of man-hours were devoted to countering the Scud threat. Some suggest that the coalition wasted resources against Scuds that could have been used to attack other targets, perhaps ending the war more rapidly. There is no doubt that "Scud hunts" diverted some military resources of the coalition, however, the utility of the Scud hunts may be better measured in political

rather than military terms. Indeed, the experience of Desert Storm helped shape how the United States is now actively investing to better defend against missile threats in the future.

The U.S. Army, Navy, and Air Force have spent billions of dollars developing systems to defeat theater ballistic missiles.[4] While the programs of the individual services frequently overlap, several Department of Defense organizations, including the Missile Defense Agency (MDA) and the Joint Theater Air and Missile Defense Organization (JTAMDO), use the concept of an integrated "family of systems" to defeat ballistic missiles.[5] Indeed, the Secretary of Defense, Donald H. Rumsfeld, recently directed the Missile Defense Agency to develop a single integrated ballistic missile defense system -- one that no longer differentiates between theater and national missile defense.[6]

, in the near-term, the greatest missile threat is likely to reside in the warfighting theaters. In fact, since 1980, the Missile Defense Agency notes that ballistic missiles were used in six regional conflicts.[7] Proliferation of missile technology and weapons of mass destruction is likely to increase this regional threat in the near future, while a longer-range missile threat to the U.S. mainland is still in its nascent stage.

This study examines several themes that become evident planning to counter the missile threat in the near-term. First, while the U.S. Department of Defense has many missile defense programs under development, one option that actually works *now* is attack operations. Attack operations present an attractive option; because these anti-missile actions can be improved with minimal changes in the defense infrastructure and modest development costs, building upon sensor and command and control investments underway. Moreover, attack operations can work well against long range or intercontinental ballistic missiles, as well as the more immediate, in the contemporary strategic environment, shorter-range theater missile threats. This capability certainly fits in the paradigm of a multi-layered, holistic missile defense system. However, attack operations currently receives the least funding and attention of all missile defense systems.

Second, no single Air Force or joint commander controls the full spectrum of missile defense from development to employment. Missile defense is a complex part of a military plan that involves many systems that operate during each phase of a conflict in defending against ballistic missile attacks.[8] Missile defense may span numerous geographic regions, require cooperation between several regional Commanders in

Chiefs, and as long-range missile threats proliferate, will include the new Northern Command, for defense of North America. Further complicating command and control is the fact that conceptual, developmental, and integrating responsibilities are divided among numerous organizations and services, and current capabilities are limited. For example, the U.S. Army's Theater High Altitude Area Defense (THAAD) as well as Sea-based Midcourse System (successor to the U.S. Navy Theater Wide system) are important developmental programs, which consume significant portions of the missile defense budget, but are not yet deployed.[9] Likewise, the Patriot is a relatively effective weapon for defending point targets, but does not provide an area defense capability and has the drawback of potentially raining deadly debris on friendly territory. Finally, the Air Force's Airborne Laser is an important program for the future, but too few of these jets will be produced to provide complete 24-hour coverage in more than one major theater of operation. Development, command relationships, and command and control of current and emerging systems is a complex problem.

Third, the political and strategic priority that is assigned to missile defense contrasts starkly with the limited emphasis on attack operations. Importantly, this is true even though the military currently needs options for defending against ballistic missiles before the previously mentioned systems are fully developed and fielded. Only with the integration of offensive and defensive systems, both doctrinally and functionally, will the United States have an effective and coordinated capability for defending against the full spectrum of missiles.

This study proposes four options that are available to the Air Force for improving missile defenses, thus addressing some potential near-term anti-access threats. The first involves training and equipping specifically for the attack operations and time-sensitive-target missions within the existing Air Expeditionary Force structure. The second proposal discusses creating a single Air Force staff office responsible for integrating plans, programs, and doctrine for attack operations, missile defense, and time-sensitive-targeting issues. Option three is a change to emphasize attack operations and time-sensitive-targeting in Air Force doctrine and acquisition plans. Finally, the fourth is to change joint doctrine to reflect that offensive anti-missile actions, such as attack operations, and sensors and command and control, are fundamentally different than static, surface based, missile defense layers, and present unique challenges and opportunities that are not illuminated in current joint doctrine.

Although there is a new national strategy for missile defense, the Secretary of Defense's concept of a multi-layered defense consisting of air, land, sea, and perhaps eventually space-based platforms with supporting joint and service doctrine, has yet to evolve at the same pace as technological advances. For the time being, the Air Force can reliably retain the current concepts of offensive counterair, aerial interdiction, and strategic attack as it formulates roles for using traditional air and space power to defend against missiles.[10] Yet, at some point, the Missile Defense Agency's defense architecture and the joint community will need to resolve the status of pre-emptive anti-missile attack operations in an integrated joint missile defense strategy. It will also need to address impending command and control tensions between a theater commander's immediate priorities and defense of the U.S. homeland. Indeed, allocation of attack operations assets, how many missions should be devoted to destroying targets that could threaten theater, regional, or the U.S. homeland, will be at least as complicated as resolving other long-term missile defense allocation issues. These might include the pending question of how the United States can best defend against, and not be deterred by, an enemy who possesses both shorter-range missiles, which pose a threat to U.S. forces and allies, and intercontinental-range missiles that could touch the U.S. itself.

There are several other reasons why an anti-missile strategy is important, particularly to the U.S. Air Force. First, since theater missile defense will likely occur in a joint and combined environment, it is essential to have a strategy that integrates multiple layers of defensive systems to protect friendly troops and civilian population centers -- especially when one missile with a WMD payload, that successfully penetrates ground point defenses, could decimate a friendly city or U.S. and allied forces. Moreover, missile defense is often a responsibility delegated to the Joint Forces Air Component Commander (JFACC). Another reason is that enemy threats, particularly anti-access threats, will have a significant effect on future strategies, which in turn has significant implications for cost, operational flexibility, and national policy. Moreover, the traditional U.S. vision of aerospace power, which relies on using air power offensively, provides a conceptual basis for using current and future air and space operations in this anti-access role, and is already embedded in Air Force doctrine. Yet, joint doctrine relegates *offensive* attack operations as a subset of missile *defense*.[11]

To set the stage for investigating these issues, the study begins with examining historical cases of defending against missiles. Notably, Operation CROSSBOW in World War II and the "Scud Hunts" of DESERT STORM serve as examples of missile defense attack operations while Operation ENDURING FREEDOM demonstrated increasingly sophisticated time-sensitive-target capabilities. Subsequent sections of the study evaluate various options proposed by several different organizations for near-term missile defense. The study concludes with four specific actions or options the U.S. Air Force might adopt that are likely to improve contributions to defending against missiles and successfully operate in a potential anti-access environment .

II. Historical Background on Missile Defenses

Fundamentally, a state or group develops ballistic missiles to destroy targets and to create terror in societies through the use of relatively cheap and available technologies.[12] Historically, destruction and terror encourage the development of technologies for defending against ballistic missiles. The inclusion of weapons of mass destruction gives comparatively weak states the ability to threaten U.S., NATO, and United Nations (U.N.) forces, as well as friendly cities or other population centers. Since most adversaries cannot defeat the United States on a conventional battlefield, deploying weapons of mass destruction on ballistic missiles may deter U.S. military activities in view of growing American concerns about casualties or through threatening allies and coalition partners. Not surprisingly, therefore, the United States engages in significant technological efforts to reduce the threat posed by missiles and weapons of mass destruction.

The current U.S. Air Force approach for dealing with theater missiles differs from that of the other military services, principally because it relies on using air power *offensively* to destroy ballistic missiles. Attack operations, the Airborne Laser, and eventually the Space-based laser, are examples of this offensive approach. In contrast, surface forces typically seek to protect themselves through defensive means, while later shifting to the offense after their security is assured. This may demonstrate the difference of opinion that exists between defensive land force strategies and offensive air power strategies, as reflected by the legacy of Douhet, Mitchell, the Interwar Air Corps Tactical School, the Combined Bomber Offensive of World War II, Desert Storm, and Allied Force. While an offensive, preemptive strategy can defend wide areas, the billions of dollars invested in defensive theater missile systems have thus far produced short-range, point defense systems that, upon destroying an incoming missile in the terminal stage, leave allied forces potentially vulnerable to raining debris. As will be seen, these differences have important consequences for how the United States defends itself against theater ballistic missiles now and after new area defensive systems are deployed, as well as defending against future long-range intercontinental ballistic missiles.

Operation Crossbow

The first substantial use of missiles occurred in World War II. However, the development of this class of weapons has its roots in Zeppelins and Gotha bombers, which introduced aerial terror bombardment to the "civilized" nations in World War I. As early as 1915, inventors in the United States experimented with the idea of a "flying bomb," which led to testing a prototype device in 1916.[13] However, it was in World War II that the world saw the first massive employment of systems similar to the current generation of missiles, notably the German V-1 and V-2 systems.

In response, the Allies launched Operation CROSSBOW against the German missile threat in the European theater. Between August 1943 and March 1945, the U.S. Army Air Forces and Royal Air Force flew 68,913 sorties and expended 122,133 tons of ordnance in the campaign to destroy German missiles.[14] Indeed, Operation CROSSBOW was a large-scale counterair operation that diverted substantial tactical and strategic aircraft to delay V-weapon attacks and limit their effectiveness once Germany began to employ these weapons.[15]

This is worth examining because there are several parallels between the use of V-weapons in World War II and recent concerns about ballistic missiles. The problem, then as now, was that military intelligence could not effectively find V-1 and V-2 missiles, and furthermore, the Allies did not have the technology that could accurately pinpoint and destroy missile sites. Although the destruction of V-weapons was viewed as absolutely critical, and though many V-1 launch sites were destroyed and their scientists killed, the overall effectiveness of the allied attacks was limited with thousands of V-weapons launched.[16] As General Dwight Eisenhower noted, if the Germans had been successful in maturing their V-weapon capability six months earlier, then the allied invasion would have been "exceedingly difficult, perhaps impossible…."[17]

Politically, Winston Churchill recognized the threat to Britain by late 1942 or early 1943, as military intelligence reports alluded to the possibility of gas agents on German missiles.[18] In response to deteriorating morale and public pressure to respond to the V-weapons, Churchill created a panel to investigate and make recommendations about the German missiles.

The Allied response to the V-weapons, which is analogous to what the U.S. Air Force currently calls offensive counterair and a strategic air campaign, was based on attacks against launch sites, storage, and production facilities. These measures included aerial bombardment, anti-aircraft artillery and night interceptors. Radar and ground control was also used to maneuver allied fighters to shoot down V-1s in flight. Anti-aircraft artillery was a point defense measure of last resort that was designed to destroy incoming missiles. In the end, this modest system comprised an *ad hoc* but multi-layered missile defense approach.

While the German V-1 missile launch facilities were vulnerable, the cost of attacking these sites was a heavy burden for the allies. During 25,150 attack sorties conducted by 154 allied aircraft, 771 crewmembers were lost between December 1, 1943, and June 12, 1944.[19] As allied aircrew hunted for camouflaged or concealed launch sites with binoculars on the basis of limited intelligence, another 26,000 Allied sorties were flown between June 12 and September 3, 1944. Unfortunately, these sorties had only limited success against the V weapons.[20]

The V-2 missile's faster and higher ballistic missile profile made it more difficult to locate and destroy after launch than the V-1. Between September 1944 and March 1945, approximately 2,500 V-2 missiles caused thousands of casualties in Britain and on the continent.[21] Despite the British emphasis on destroying these weapons, the only attack option the Allies pursued which had a significant effect was to strike the German transportation system.[22] While it was not successful in stopping casualties caused by these missiles, Operation CROSSBOW slowed the introduction of the V-1 and V-2 by three to six months, which made the operation a qualified success.[23]

Emerging USAF Missile Defense Roles

The need to define missile roles for the Air Force and its parent, the Army, emerged when the Air Force became a separate service when the National Security Act was signed on July 26, 1947. The Army-Air Force Implementation Agreements, signed on September 15, 1947, defined the separate functions of the services, including assigning certain intelligence functions, strategic missile responsibility, air defense anti-aircraft artillery, and research and development responsibility for guided

missiles to the Air Force. The Army retained control of tactical missile systems, while responsibility for strategic systems was given to the Air Force.[24] Although these agreements helped to define the respective roles and functions of the two services, it was followed by years of contentious debate.

Over the next several years, there were numerous modifications to the roles of the three services in missile programs. On July 19, 1948, the Air Force gave the Army control over research and development for guided missiles that would support Army roles and missions. Since all three services required guided missile programs, Secretary of Defense Louis A. Johnson signed a Guided Missile Memorandum on March 21, 1950, which sought to reduce the overlap between the systems and the lack of "clear delineation" of the responsibility for current and future missile systems.[25] This memorandum gave the Air Force exclusive control over strategic missiles, missiles that replaced fighter interceptors (in conjunction with the Navy), and ground support aircraft (in conjunction with the Army). Additionally, the Air Force and Navy shared responsibilities for specific air-to-air and air-to-ground missiles.[26] The Vandenberg-Collins Agreement, signed on August 1, 1950, established roles and cooperative arrangements between the Air Force and Army for air defense organizations, and placed Army staffs at each echelon of the Air Force command structure.[27]

As the debate over roles and missions continued, in 1952 the Army and Air Force reached agreement on several points. This did not settle the roles and missions controversy despite advances in both interceptor and long-range ballistic missile technology.[28] Three separate missile development programs, one for each service, continued, as did numerous specialized ballistic and cruise missile weapons systems. Air Force guided missiles retained the designation as aircraft, and were treated as uninhabited aerial vehicles. Moreover, the Air Force created an Air Defense Command to protect the continental United States from Soviet bombers, including listening posts and collection networks in distant North America and along the coasts of the United States. The Bomarc, an early and significant Air Force attempt at an unmanned aerial interceptor to supplement the manned interceptors for the Air Defense Command, was designated the XF-98.[29]

Anti-Missile Systems

Bomarc. The Bomarc, which emerged from a 1949 agreement with Boeing Aircraft to develop a pilot-less interceptor that was designed to destroy bombers and cruise missiles, was the only surface-to-air missile that was designed by the Air Force.[30] Launched vertically, the Bomarc would climb to altitudes over 50,000 feet and then rotate to a horizontal flight profile, much like an airplane. When it was within ten miles of its target, the Bomarc's internal radar would guide the unmanned aircraft to complete the interception. In 1961, the Super Bomarc (Bomarc B) was tested against two U.S. Navy Regulus II missiles, and successfully intercepted the designated target at Mach 2, 100,000 feet altitude, and 375 miles downrange.[31] At its height, the USAF Bomarc missile defense force consisted of 242 Bomarc B missiles. Their deactivation began in 1964, and the last Bomarc was deactivated on July 1, 1972.[32]

Nike. With its genesis in World War II, the Army Nike project was formally instituted on February 8, 1945, after a contract was issued to conduct a study on anti-aircraft guided missile problems.[33] In August 1945, the Army Air Forces learned that the Army Ordnance Department planned to change the Nike into an interceptor missile by adding airfoils to give it maneuverability. This development violated the McNarney Directive, which stipulated that the Army Air Forces would develop missiles that relied on lift or that were launched from aircraft. Additionally, this directive compelled the Army Ordnance Department to develop surface launched missiles that relied on momentum for flight. Interestingly, doctrinal tension over missiles was evident even before the creation of a separate U.S. Air Force.[34]

The Army's Nike Hercules represented an improvement to the Nike line that was planned before the Nike Ajax became operational. Achieving a production level of more than 25,000 with 863 deployed by the United States, the Nike Hercules was designed to defend against the threat posed by Soviet nuclear-armed bombers. Although Congress sought to decommission the Hercules in 1968, pressure from NATO allies continued its deployment until the SAM-D (now called the Patriot) was available. The last Nike Hercules was withdrawn from Europe in 1984.[35]

Another member of the Nike line was the Nike Zeus. While the Nike Hercules was designed for bomber defense, the Nike Zeus was designed to intercept hypersonic aircraft and ICBMs. The Nike Zeus represented a significant step in missile defense because it was designed to intercept its targets in space. Before the Soviet Sputnik launch, all U.S. Army missiles were restricted to a 200-mile maximum range, but after Sputnik, this range restriction was rescinded, which opened new venues for Army space operations. Although never deployed as an anti-ballistic missile, Nike Zeus became operational as an Army nuclear delivery platform.[36]

Thor. The debate over tactical and strategic systems continued during the Thor project, which was originally known as a Tactical Ballistic Missile, but was later designated as an Intermediate Range Ballistic Missile, with a range of 1,000 to 2,000 miles. Although planned to replace the Matador tactical missile, the Air Force decided that Thor was a strategic weapon. Additionally, Thor was intended to counter a Soviet fractional orbital bombardment system that was proposed in the late 1950s. In a parallel development track, the Thor continued as an Air Force program, while a combined Army-Navy Ballistic Missiles Committee began to develop the Jupiter Intermediate Range Ballistic Missile. At that point, intercontinental ballistic missiles (ICBM) and intermediate range ballistic missiles were given equal priority.[37]

The Air Force continued to consider the question of missile priorities, development, and deployment.[38] A revised Air Force plan released on November 10, 1955, provided detailed plans on ICBM and IRBM administrative procedures. It also called for two intermediate range missile programs of equal priority, an Office of the Secretary of Defense Ballistic Missiles Committee, and an Air Force Ballistic Missiles Committee. Once Sputnik was launched on October 4, 1957, however, U.S. intercontinental missile programs accelerated. Given the dynamic nature of missile programs, Air Force leaders made frequent administrative and organizational changes.[39] Yet, as the programs developed, new technologies, doctrinal confusion, and mission overlap continued to exist.

Sprint/Spartan. As a result of Nike Zeus shortcomings in destroying ballistic missiles in the atmosphere, the Army began a study in 1959 to develop a high-speed, terminal phase interceptor. Concurrently,

the improved Nike Zeus became the Spartan interceptor, which was the last U.S. nuclear tipped anti-ballistic missile (ABM). Together, these two weapons systems were designed to provide overlapping coverage against nuclear-armed ballistic missiles.

In September 1967, Secretary of Defense McNamara announced that President Johnson would deploy the Sentinel ballistic missile defense system. In 1969, President Nixon renamed the Sentinel system the Safeguard system, and realigned the system to protect U.S. ICBM launch facilities.[40] While test missiles were flown from 1970 to 1973, the development of U.S. ABM systems was severely restricted with the signing of the SALT I treaty on May 26, 1972. With the signing of the Anti Ballistic Missile Treaty on July 2, 1974, the United States and Soviet Union were each restricted to two ABM sites with 100 interceptor missiles, which further slowed the development of U.S. anti-ballistic missile systems. On October 1, 1975, the only U.S. ABM site, at Grand Forks, North Dakota, became operational with seventy Sprint and thirty Spartan interceptor missiles.[41] In 1983, further development of the Sprint and Spartan weapons systems was replaced by research into conventional missile defense technologies.

Strategic Defense Initiative

President Ronald Reagan announced a new missile defense policy in a speech to the nation on March 23, 1983. National Security Directive 85 formalized the policy announcement, which called for an extensive research and development program to create a missile defense system to protect the United States against nuclear-armed ballistic missiles. Two studies were commissioned and completed within a year: the Future Security Strategy Study (the Hoffman Report) and the Defensive Technologies Study (the Fletcher Report).[42]

These reports formed a framework for the Strategic Defense Initiative. The Hoffman Report argued that missile defenses could enhance deterrence and that an anti-tactical ballistic missile system could provide the technological foundation for national missile defense. The Fletcher Report, which was not completed until early 1984, proposed different funding levels and plans for the President's research programs. The recommended plan, which became a guide for the Strategic Defense Initiative, recognized that there are common links between terminal

theater and ICBM defenses. On January 6, 1984, Presidential National Security Decision Directive 119 formally established the Strategic Defense Initiative to explore "the possibility of developing missile defenses as an alternative means of deterring nuclear war."[43] While the resurrection of missile defense sparked debate over the provisions and necessity of the ABM treaty, the Strategic Defense Initiative program continued to develop non-nuclear technological options for ballistic missile defense.

Concurrently, a State Department legal advisor concluded in 1987 that the ABM treaty did not "preclude testing of space-based missile defense systems, including directed energy weapons."[44] Furthermore, the 1967 Outer Space Treaty did not necessarily prohibit other options under consideration, including defensive satellites, anti-satellites, and active terminal defense systems.[45] The treaty did, however, prohibit nuclear weapons on-orbit in space, and military bases and weapons testing on the moon or other undefined celestial bodies.

Theater missile defense was studied in parallel with the more highly publicized national missile defense programs, which were principally concerned with defending the continental United States against Soviet intercontinental ballistic missiles.[46] The PAC-2 Patriot successfully destroyed a Patriot missile that simulated an SS-23 ballistic missile in a November 1987 test, while studies into "Brilliant Pebbles"--a space-based 'hit-to-kill' interceptor--continued during the Reagan and Bush administrations. However, when Iraq invaded Kuwait in August 1990, theater missile defense emerged as such a predominant factor in U.S. defense planning that the FY 1991 Appropriation Conference Committee Report called for a centrally managed theater missile defense program to be established by the Secretary of Defense, with additional funding to be provided.[47]

Persian Gulf War

The Scud missile was probably Iraq's most noteworthy, if not most sophisticated, weapon in the 1991 Gulf War, also known as Operation DESERT STORM. While the U.S. Central Command (CENTCOM) launched nearly 1500 air strikes against Iraqi missile crews, it could not completely halt the ubiquitous Scud missile attacks.[48] Although Iraq employed theater ballistic missiles during the Iran-Iraq war in the 1980s,

few appreciated the possibility that U.S. troops might be attacked by ballistic missiles armed with biological or chemical agents in Southwest Asia. Furthermore, Iraq's use of the missiles against Israel threatened to bring about an Israeli response that could destroy the coalition.

U.S. forces were not completely unprepared to deal with theater ballistic missiles, however. Using a combination of defensive and offensive measures, a moderately effective missile defense posture was deployed during Operation DESERT SHIELD. Fighter-bomber aircraft attacked fixed Scud sites with a high degree of reliability, and preemptively attacked mobile Scud transporter-erector-launchers, although with somewhat lower confidence given limitations associated with the real-time intelligence and command and control. Additionally, Patriot PAC-2 missiles, whose modifications during the 1980s increased its anti-missile capabilities, provided back-up point defenses as a final layer of missile defense, complementing coalition attack operations against enemy missiles and the supporting infrastructure. Without the combination of offensive air power, defensive anti-missile systems, U.S. deterrence capabilities, and the conventional capabilities of the United States and its coalition partners, it was conceivable that Scud missiles armed with weapons of mass destruction could have killed thousands. In this case, an inaccurate, older, and less technologically advanced tactical weapon would have had significant strategic effects.

Although U.S. Central Command planners had plans to attack fixed Scud launchers in Iraq, they did not plan to attack the mobile launchers because Scud missiles were initially considered to be only a "nuisance" weapon.[49] Air Force General Glosson believed that there would be a "Scud Hunt" for "political" reasons, although General Schwarzkopf, very early in the campaign, reportedly believed that Scuds had "little military significance."[50] However, General Schwarzkopf quickly modified the air campaign on the second day of the war when "the first Scud missiles launched from western Iraq landed in Israel."[51] The potential that weapons of mass destruction might be involved, combined with Israel's possible entry into the war preoccupied the Bush administration.[52]

Iraqi fixed Scud sites were targeted on the first night, particularly in western Iraq, but the pervasiveness of the mobile Scud threat became obvious when Iraq fired Scuds at Israel. Considerable numbers of U.S. joint air assets were diverted from strategic attack, interdiction, and other missions to suppress the mobile Scuds. Not only did the Scud attacks

divert more aircraft and military resources than expected, but the inconclusive results of the preemptive attacks against mobile launchers raised questions about the effectiveness of attack operations against mobile Scud transporter-rector-launchers. The Scud Hunt involved continuous airborne surveillance of western and southern regions of Iraq, repositioning airborne strike aircraft for more rapid targeting, attacks on Scud-related communications links, attacks on suspected launch sites, and strikes against Scud production and storage facilities. By the end of the war, nearly every type of strike and reconnaissance aircraft employed was involved to some degree in efforts to control the Scud missile threat.[53]

Although the rate of Scud launches decreased significantly after coalition forces began coordinated attack operations, there were obvious faults with the joint method of conducting preemptive attacks against missiles. The most critical problem was the lack of near-real-time intelligence and information. For example, it was difficult to rapidly exchange accurate information between special operations forces and attack aircraft, which did not always have the appropriate sensors available for finding and destroying mobile transporter-erector-launchers before they were able to hide after launching a missile.[54] Thus, with no concrete evidence of transporter-erector-launcher destruction, the *Gulf War Airpower Survey* noted that attack operations were of limited effectiveness. However, the weekly launch rate of Scud missiles decreased by approximately fifty percent after the first week and remained low during the conflict. This demonstrated that the coalition's anti-missile operations were effective for Scud suppression, but less successful in the destruction of mobile Scuds.[55]

On February 25, 1991, a conventionally armed Scud tragically destroyed a U.S. barracks in Saudi Arabia, killing twenty-eight Army reserve soldiers from Pennsylvania. Indeed, Scud parts raining down on Israel and Saudi Arabian cities suggested that point-defense systems, particularly the Patriot, were not an optimum defense. While Patriot missiles helped to maintain the coalition and persuade Israel not to retaliate, their effectiveness as missile-interceptors was qualified.[56] In fact, in Israel the damage caused by Scud missiles increased 300 percent after Patriots were employed and the death toll rose by fifty percent, simply because intercepting the missiles created more debris.[57] Importantly, the public debate about the operational effectiveness of Patriot and the threat posed by theater ballistic missiles encouraged

political and military authorities to accelerate the pace of research and development for theater missile defense.[58]

Theater Missile Defense and Anti-Missile Efforts in the 1990s

Efforts in the United States to respond to Scuds and other theater missiles accelerated after the Persian Gulf War. On December 5, 1991, President George Bush signed H.R. 2100, the "National Defense Authorization Act for Fiscal Years 1992 and 1993," which required the Department of Defense to "aggressively pursue the development of advanced theater missile defense systems, with the objective of down selecting and deploying such systems by the mid-1990s."[59] As a result, numerous operational tests and exercises were conducted in the areas of attack operations; battle management command, control, communications, computers, and intelligence (BMC4I)[60]; and various defensive systems. In 1993, the Strategic Defense Initiative office was re-designated as the Ballistic Missile Defense Organization (BMDO), and the 1993 Bottom-Up review provided $12 billion to Theater Missile Defense for the fiscal years 1995 through 1999.[61] This substantial commitment of funds demonstrated that the United States intended to pursue a serious research and development program for missile defense.

The tests and exercises that were conducted by the Air Force expanded its capability to contribute to theater missile defense, particularly in the areas of BMC4I, Airborne Laser, and attack operations tests and exercises.[62] Thus, the Air Force approach shifted toward promoting the inherent flexibility of aerospace power to destroy missiles, transporter-erector-launchers, missile-support equipment, and personnel, all under the joint heading of "attack operations." However, the tactics, techniques, and procedures of attacking mobile Scuds and other similar targets were generally grouped under the rubric of time-critical-targeting, now commonly referred to as time-sensitive-targeting. Indeed, Air Force theater missile defense programs also had some potential against longer-range missiles, but the ABM treaty prevented testing against those systems.

The time-sensitive-targeting approach to attack operations, however, went beyond attacking transporter-erector-launchers. Expanded

attack operations include degrading enemy missile systems, launch and maintenance infrastructure, and destroying individual missiles. The incorporation of direct and indirect attacks by the Air Force further advanced U.S. anti-missile strategies.[63] In addition, analyses conducted after the Persian Gulf War by the Air Force increased the emphasis on transferring accurate and timely tactical information to aircrews, further advancing time-sensitive-targeting. This desire to achieve faster and more accurate information flow to aircrews became known as a "sensor-to-shooter loop," or "kill-chain." The emerging goal became to find, fix, target, track, engage, and assess targets as rapidly as possible, to overwhelm enemy defenses and maneuver.

To integrate the Department of Defense's requirements and activities for Theater Air and Missile Defense, the Joint Theater Air Missile Defense Organization (JTAMDO) was created in 1997."[64] While the Ballistic Missile Defense Organization was to concentrate on planning, developing, and testing national and theater missile defense systems, JTAMDO was tasked with defining requirements and validating capabilities.[65] JTAMDO sought to involve component commanders and military services in the development of joint mission requirements, theater missile defense architectures, and joint capabilities. The Joint Theater Air Missile Defense Organization fell under the J-8 directorate of the Joint Staff, which is responsible for defense planning, operates separately from the individual military services, and provides support for the Chairman of the Joint Chiefs of Staff.[66]

In 1999, Operation Allied Force, the campaign against Serbian oppression in Kosovo, demonstrated the usefulness of a maturing air operations center structure for command and control and integration of real-time intelligence, particularly against time-sensitive-targets. Though ballistic missiles did not become a factor in the campaign, lessons learned in coordinating air operations allowed further advances in command and control, sensor integration, unmanned aerial vehicle (UAV) support, and time critical targeting, which have significantly enhanced current attack operations capabilities.

The New Century through 2002

The September 2001 Quadrennial Defense Review (QDR), published in the shadow of the September 11, 2001, al Qaeda terrorist attacks, recognized a changing international strategic environment. In response, the QDR articulated the need for transformational change in the U.S. military.[67] One important directive stated that the Department of Defense would examine options for establishing standing Joint Task Forces to address the capability to "continuously locate and track mobile targets at any range and rapidly attack them with precision."[68] The QDR also noted that the continued proliferation of ballistic and cruise missiles are a threat to "U.S. forces abroad, at sea, and in space, and to U.S. allies and friends."[69] Therefore, the QDR emphasized that the Department of Defense was shifting the focus of missile defense toward research and deployment of a layered system of systems. This was envisioned to defend forward deployed troops and allies threatened by theater missiles, and provide a "limited defense" against missiles for the U.S. homeland.[70] To this end, the QDR proposed several transformation initiatives.

> 1. Protect bases of operation at home and abroad and defeat threat of CBRNE [chemical, biological, radiological, nuclear, enhanced high explosive] weapons.
> 2. Assure information systems in the face of attack and conduct effective information operations.
> 3. Project and sustain U.S. forces in distant anti-access and area-denial environments.
> 4. Deny enemies sanctuary by providing persistent surveillance, tracking, and rapid engagement.
> 5. Enhance the capability and survivability of space systems.
> 6. Leverage information technology and innovative concepts to develop interoperable Joint C4ISR.[71]

Operation ENDURING FREEDOM, the campaign against the al Qaeda terrorist network and Taliban regime in Afghanistan in late 2001 through

2002, highlighted the maturation of time-sensitive-targeting capabilities and the Combined Air Operations Center command and control organization. Among numerous noteworthy accomplishments in the campaign were real-time intelligence to the warfighter, long-range precision global strike and rapid retargeting of multiple platforms, in support of real-time requirements.

For example, the world endurance record for a combat mission (forty-one hours) was set by a B-2 which departed from Whiteman Air Force Base, Missouri, communicated via e-mail with command and control units enroute, delivered precision ordnance on targets in Afghanistan, and then landed at Diego Garcia. In another example of maturing capabilities, the Combined Air Operations Center linked a U.S. Air Force combat controller, who was on the ground supporting Northern Alliance troops, with a B-52 orbiting over Afghanistan. The controller directed the B-52 to attack enemy positions from high altitude with advanced wind guided munitions, destroying the enemy position in only eighteen minutes from the first call for support. Moreover, ENDURING FREEDOM saw the most extensive use of unmanned aerial vehicles in history, including armed UAVs, a capability important for anti-access threats and time sensitive targeting.[72]

These capabilities, precision, speed, and flexibility made effective by responsive command and control, are direct outgrowths of lessons learned from DESERT STORM. Moreover, in response to the QDR and lessons emerging from ENDURING FREEDOM, the U.S. Air Force recently began exploring the concept of multiple function Task Forces to include Global Strike; and Intelligence, Surveillance, and Reconnaissance Task Forces.

As a result of these emerging capabilities, the current administration has begun to readdress traditional missile defense concepts in favor of a wider view. On November 12, 2001, shortly after announcing that the U.S. would unilaterally cut its nuclear arsenal by roughly sixty percent, the George W. Bush administration announced its intent to withdraw from the ABM treaty. This will allow the U.S. to begin missile defense testing after a six-month waiting period expires and the treaty becomes void. [73]

On January 2, 2002, the Ballistic Missile Defense Organization reorganized and became the Missile Defense Agency. The Agency's new philosophy is to merge national and theater missile defense concepts into a single research, development, and test program focusing on "missile

defense as a single integrated… system."[74] This system will consist of elements configured into layered defenses to provide autonomous and mutual support, including multiple engagement opportunities, along a threat missile's flight path.[75]

This realignment, which came after the December 14, 2001, cancellation of the Navy Area terminal missile defense program, divided remaining programs into threat envelopes based on the course of a ballistic missile's flight trajectory.[76] Aligning programs under the segment of flight during which a system intercepted an enemy missile, supported the Missile Defense Agency's emphasis on a multi-layered defense structure divided into three segments: the boost segment, the mid-course segment, and the terminal segment. Moreover, the Missile Defense Agency recognized the importance of sensors, the need for a future U.S. Navy terminal system, and incorporated the Air Force Space Based Laser research project under the boost segment.[77] Notable by its absence, however, was a segment devoted to attacking missiles and support structures *before* launch -- or attack operations.

The reorganization of the Missile Defense Agency and the removal of the artificial barriers between theater and national missile defense portend both procurement and doctrinal shifts in the near future. Reportedly, nearly half of the $7.8 billion missile defense request for fiscal year 2003 will go to mid-course programs with $2.1 billion going to the ground based mid-course missiles likely to be deployed in Alaska. Annual funding is then expected to decrease slightly through 2007. Less than $800 million is earmarked for boost-phase anti-missile defenses, though that is expected to rapidly increase by 2007. Finally, nearly $2 billion of the 2003 request is planned to go toward terminal defense systems.[78]

The doctrinal changes and joint attack operations investment will likely involve the Joint Air and Missile Defense Office.[79] When theater and national missile defense merged into the layered missile defense concept, JTAMDO took responsibility for developing concepts of operations for the integrated system. The Pentagon has recently requested to nearly triple the funding of JTAMDO in fiscal year 2003. Roughly, $23 million will be used for cruise missile combat identification research, $18 million for air and missile defense modeling and simulation, and $5 million is slated for development of "joint operational concepts and architecture for missile defense."[80] JTAMDO is presently tasked with: serving as a voice for the Commanders in Chief and services; leading

collaborative efforts on operational matters; developing operational concepts, operational architectures, and assessment; and working closely with the Missile Defense Agency on architecture and integration efforts.[81]

In summary, the development of missile defense has its historical roots in World War II, in the fight to counter Nazi rockets and cruise missiles. However, over fifty years of evolving doctrinal disagreements within and between the services complicated the question of what is the best way to reduce the threat posed by missiles, and particularly those whose payloads might include weapons of mass destruction. While the multi-layered approach of battle management command and control, sensors, attack operations, and the Airborne Laser represents the U.S. Air Force's near-term contribution to missile defense, it is essential for policy makers to strike a balance between specific systems that provide capabilities for attack operations and the well-funded Missile Defense Agency point-defense systems. Moreover, doctrinal considerations, such as the role of the Joint Forces Air Component Commander in theater and regional air defense; the command and control relationships, particularly with a mix of short and longer-range missile threats; the weight of effort for offensive attack operations versus other target-sets; and a equilibrium between funding and operating a variety of missile defenses, remains important.

III. Missile Defense and Anti-Missile Options

Ballistic Missile Threat

Some contend that within ten years every southern European capital will be within range of ballistic missiles based in North Africa or the Levant (including Syria, Iraq, and Iran).[82] Many allies, including the particularly vulnerable southern European countries, such as Portugal, Spain, Italy, Turkey, and Greece, lack the ability to successfully defend against missile strikes or deter attacks with weapons of mass destruction. While allies may still offer access to bases and airspace and/or contribute military forces, the United States will face a radically different European security problem if Madrid, Rome, or Athens are at risk to missile attack.[83]

Country	Ballistic Missiles
Afghanistan	Scud-B
Belarus	Scud-B, SS-21
China	CSS-2, CSS-3, CSS-4, CSS-5, CSS-6, CSS-7, JL-2*, CSS-NX-3*, DF-31*, New ICBM*
Iran	Scud-B, Scud-C, CSS-8, Shahab 3*, Shahab 4*, Iran 170*
Iraq	Al Hussein, Scud-B, Al Samoud*
Libya	Scud-B, Al Fatah*
North Korea	Scud-B, Scud-C, No Dong, Taepo Dong 1*, Taepo Dong 2*
Pakistan	Hatf-1, CSS-7, Hatf III, Shaheen*, Shaheen II*, Ghauri* II
Russia	SS-18, SS-19, SS-24, SS-25, SS-27, SS-N-8, SS-N-18, SS-N-20, SS-N-23, Scud-B, SS-21, SS-1c, SS-X-26*, New ICBM*, Bulava-30*
Syria	SS-21, Scud-B, Scud-C
Turkmenistan	Scud-B
Ukraine	Scud-B, SS-21
Vietnam	Scud-B
Yemen	SS-21, Scud-B

Table 1: Ballistic Missile Proliferation Challenges—2001
*Missiles Not Yet Deployed

In a military sense, the threat in the Mediterranean region has shifted dramatically as the focus in Europe changed "from the Fulda Gap to the South."[85] Indeed, the problem of susceptibility to missile and WMD attacks is not confined to Europe (see Table 1).

Requirements for Missile Defense

The *Theater Missile Defense Mission Need Statement*, which was approved by the Joint Requirements Oversight Council (JROC) on November 18, 1991, established the requirement for a theater missile defense capability that can protect U.S. forces, allies and other important countries, and areas of vital interest against missile attacks.[86] Overall, the importance of theater missile defense in defense planning has increased since the Persian Gulf War, particularly because theater ballistic missiles could be armed with weapons of mass destruction. The JROC Mission Needs Statement for theater missile defense also noted that the threat posed by theater missiles could not be countered by any single system, but would require a mix of capabilities.[87] This reasoning institutionalized the requirement for pursuing various technological approaches to theater missile defense, while preserving the freedom to integrate the completely different systems and philosophies that are often the source of doctrinal friction among the military services.

In some cases, the term "theater missile" might be deceptive as these devices give potential adversaries a truly strategic weapon, even if its range might make it appear tactical in nature. With theater missiles, states gain a relatively low cost means for threatening population centers and such critical targets as ports and other points of entry in order to coerce neighbors, weaken military coalitions, and deter U.S. military involvement in regional crises. Furthermore, missiles armed with chemical, biological, or nuclear payloads radically increase the political and military stakes in a crisis.[88]

A complicating factor, particularly with short and medium range theater ballistic missiles, is the challenge posed by mobility. Though mobile missiles may be less accurate than those launched from fixed sites, they are more survivable in the pre-launch phase due to the uncertainty of location until launch detection. Destroying these missiles is made more difficult by their mobility. The targets must be detected, identified,

tracked, then that information must be passed to a platform to deliver a weapon.[89] This is true for traditional active missile defense systems, but the time is particularly compressed with mobile targets, especially in order to conduct pre-launch attack operations, as accurate intelligence and the ability to rapidly attack are necessary to strike before launch.

Current Joint Theater Missile Defense Concept

The historical legacy of attacks conducted by the Army Air Forces during World War II against V-1 and V-2 missile sites is evident in Joint Publication 3-01.5, *Doctrine of Joint Theater Missile Defense*.[90] This publication consolidates the missile defense philosophies of the military services into joint doctrine by defining four operational elements of theater missile defense: passive defense; active defense; attack operations; and command, control, communications, computers, and intelligence (C4I). The concept of passive defense involves efforts to minimize the effects of theater missile attacks, while active defense includes operations that destroy enemy missile "airborne launch platforms" or missiles in flight. Attack operations seek to "destroy, disrupt, or neutralize theater missile launch platforms and their supporting structures and systems." Finally, the purpose of C4I is to coordinate and integrate these efforts. Based on the new Department of Defense's multi-layered approach and the removal of the divisions of theater and national from both missile defense systems and philosophy, this joint publication needs substantial revision.

Yet, though the multi-layered concept of missile defense presents a more holistic and global view of the missile threat, the historically different approaches pursued by the military services toward the development of missile defenses provide a source of conflict. For example, the Air Force argues that air power is best employed offensively, while the Army doctrine appears to promote that theater missile defenses should focus on ground-based systems, which are inherently reactive rather than proactive weapons.[91] Offensive counterair, which is defined in Air Force Doctrine Document 1 as the freedom *from* attack and the freedom *to* attack, is based on the Air Force proposition that "air and space forces are inherently offensive and yield the best effect when so employed."[92] Furthermore, when the Airborne Laser destroys ascending enemy missiles, it functions as defensive counterair, as expressed in Air Force doctrinal lexicon, to protect friendly forces, material, and

infrastructure. This contrasts with using special operations teams or fighter-bombers to preemptively destroy ballistic missile launchers (offensive counterair) or missile supply depots (interdiction or strategic attack).[93] A different and simplified interpretation mentioned at the November 1997 *Air and Space Conference*, is that offensive counterair occurs when parts fall on the enemy's side of the border while defensive counterair occurs when 'parts fall on our side.'[94]

According to the Air Combat Command's *Concept of Operation* (CONOPS) *for Command and Control against Time-Critical-Targets*, "The Air Force core objective for this concept is to attack and destroy theater missiles and other time-critical-targets as far into the enemy's territory as possible, when they are least threatening to friendly forces."[95] This is a further illustration of an offensive mindset. For Air Combat Command, attack operations consist of the offensive counterair, interdiction, and strategic attack that "*prevent* TM attacks."[96] Thus, one unresolved conundrum is that it appears that joint doctrine considers "offensive" aerospace or other attack operations as "defense." Furthermore, defensive counterair is the USAF version of joint active defense that *limits damage* from theater missile attacks, while joint passive defense includes early warning, WMD protection, concealment, and hardening. While there may be a subtext of doctrinal friction over the role of the Joint Force Air Component Commander in controlling all air defenses in theater, the confusion over offense and defense also raises questions about the line between attack operations and interdiction or strategic attack, particularly when missile defense and weapons of mass destruction are considered.[97]

Options for Theater Missile Defense

The Department of Defense's Missile Defense Agency has numerous programs in missile defense, including the Patriot Advanced Capability-3 (PAC-3), Theater High Altitude Area Defense (THAAD), and the Sea-based Midcourse System.[98] In addition, there are other programs available, including the Airborne Laser, Space Based Laser, kinetic energy concepts, attack operations, sensors, Battle Management Command and Control, Arrow, and the Medium Extended Air Defense System (MEADS). Although the Missile Defense Agency does the research and development of the missile defense systems, once the

decision is made to deploy a system, it is handed-over to the services to deploy.[99] This section briefly introduces the primary United States Missile Defense systems, those either under-development or deployed, as the basis for comparing systems and operational possibilities in the next section.

Terminal Segment[100]

Patriot. The Patriot Advanced Capability (PAC-3) is an upgraded version of the weapon that was used during the Persian Gulf War. According to Secretary Cohen, the PAC-3 "provides air defense of ground combat forces and high value assets against high performance air-breathing and theater ballistic missiles."[101] The PAC-3 is a point defense weapon that has some ability to defend against cruise missiles, aircraft, and theater ballistic missiles in their terminal phase of flight. While the PAC-3 can be airlifted, it is large, cumbersome to move, and thus a relatively stationary system. According to the Missile Defense Agency, the PAC-3 is the most mature of the Missile Defense Agency's theater missile defense systems. The third and final configuration was successfully tested against live missiles in mid-2000, and is now reaching initial operational capability.[102] The program is scheduled to transition to the U.S. Army in 2002.[103]

An essential feature of the PAC-3 is its "hit-to-kill" capability, which is consistent with the Missile Defense Agency's emphasis on using hit-to-kill systems against weapons of mass destruction.[104] Yet, a concern with the PAC-3 is that, as with all terminal systems, there exists a risk of debris falling on the friendly side following a successful terminal stage missile interception. The Navy Area program, a ship-borne system with similar capabilities to the PAC-3, was cancelled in 2002. This cancellation leaves the PAC-3 as America's current premier lower-tier, theater ballistic missile defense system.

MEADS. The Medium Extended Air Defense System (MEADS) is a mobile lower-tier program that the United States has pursued on a cooperative basis with Germany and Italy.[105] Planned to reduce the risks to Army and Marine Corps operations, MEADS is the only theater missile defense system that "can provide maneuver forces with 360-degree defense protection against short-range tactical ballistic missiles, cruise missiles and unmanned aerial vehicles."[106] It is intended to bridge the gap

between hand-held, man portable systems, such as the Stinger, and less mobile systems, such as the PAC-3. MEADS will be a multi-canister vertical launch system mounted on a wheeled vehicle.[107] In FY 2003, MEADS will continue design development activities for system components including adding the capability to integrate the PAC-3 missile with the MEADS system.[108]

Arrow. The Arrow, a joint U.S.-Israeli missile defense system program, will be able to operate with U.S. theater missile defense systems in order "to assist in the protection of forward deployed U.S. and coalition forces."[109] The engagement footprint of the Arrow falls between the PAC-3 and the Theater High Altitude Area Defense System. The Department of Defense hopes that Arrow flight test data will provide technological spin-offs that serves as "risk-reduction measures" in U.S. theater missile defense development.[110] The Israeli Ministry of Defense received its first Arrow missile in November 1998.[111] In October 2000, Israel declared the system operational. Continuing partnering efforts between Israel and the Missile Defense Agency will support Israeli acquisition of a third Arrow battery and promote interoperability with U.S. missile defense systems and Battle Management Command and Control.[112]

THAAD. The Theater High Altitude Area Defense (THAAD) system has been categorized by the Missile Defense Agency as an upper tier, Terminal Defense Segment system, because the intercept is planned to occur in the terminal phase of the missile's trajectory, yet on the edge of the atmosphere.

As a ground-based high-altitude weapons system, THAAD will use exo-atmospheric and endo-atmospheric, hit-to-kill interceptors to destroy missiles. The goal of the THAAD system (and other upper-tier systems) is to destroy incoming medium and short range ballistic missiles far enough from friendly troops or population centers that the debris is no danger to the intended target.[113]

THAAD has five major components: missiles, launchers, radars, BMC2, and support equipment. The Missile Defense Agency expects fielding in 2007 or 2008.[114] Essentially, the THAAD is the most mature upper-tier system, but it is also a terminal segment system.

The ability to hit theater ballistic missiles with longer range is a distinct advantage that the Missile Defense Agency maintains will give "more time for multiple shot opportunities."[115] The THAAD remains a

critical upper-tier program designed to protect "broad areas, dispersed assets, and population centers," but recent tests have produced mixed results.[116] The MDA expects to complete missile and launcher designs and begin the manufacturing of two radars, and continue with BMC2 hardware and software development in FY03.[117] Flight-testing is planned to resume in early FY 2004.[118]

Sea-Based Terminal System. In the wake of the cancellation of the Navy Area terminal defense missile in December 2001, the Department of Defense directed the Missile Defense Agency to initiate a sea-based terminal study, which is to be completed in 2002.[119] The Navy continues to have a requirement for a sea-based system, and argues that sea-borne theater missile defenses are less expensive because they use current platforms and thereby reduce the demand for airlift and sealift.[120] As a core Ballistic Missile Defense Organization weapons system, the first unit equipped was targeted for FY 2007—however, the results of the 2002 sea-based terminal study will determine new program funding and timing.[121]

Midcourse Segment

Ground-Based Midcourse. The Ground-based Midcourse System is a successor to the National Missile Defense System. This is not necessarily a *theater* missile defense, but as the view of the separation of theater from non-theater missile threats has changed, this system is now part of the Missile Defense Agency multi-layered defense approach.

The objectives of the Ground-based Midcourse System are: "1) to develop and demonstrate an integrated system capable of countering known and expected threats; 2) to provide an integrated test bed…3) to create a development path allowing for an early capability based on success in testing."[122]

Sea-Based Midcourse System (SMD -- successor to Navy Theater Wide). The Navy Theater Wide was an upper-tier system for deployment on Aegis cruisers. The successor to Navy Theater Wide is the Sea-Based Midcourse System, which will intercept enemy ballistic missiles in the ascent phase of mid-course flight. Though Navy Theater Wide was an upper-tier system, along with THAAD, the Sea-based Midcourse System is unlike the THAAD because, although it is too a mid-course trajectory

system, its emphasis is on the exo-atmospheric ascent phase.[123] The n SMD might be able to intercept theater-range ballistic missiles during the mid-course trajectory, or could provide descent-phase and terminal-phase intercepts when the cruiser is positioned near the defended area.[124] Designed to intercept medium-range and long-range ballistic missiles, SMD is expected to have a contingency capability in 2004 or 2005, with initial operational capability in the 2008-2010 timeframe.[125]

Boost Segment[126]

Airborne Laser. The primary boost-phase program for theater missile defense is the Air Force's Airborne Laser (ABL) program, which is scheduled to begin airborne demonstrations in 2003. If the testing schedule is executed, the initial operational capability of the Airborne Laser will be in 2009, with seven aircraft available for combat operations in 2011.[127] The Department of Defense view is that the ABL will help deter ballistic missile use, in part because missiles attacked during the ascent phase would land on enemy territory.[128] The Airborne Laser's rapid deployment capability is also important for the deterrence, detection, or destruction of missiles early in flight. Since future generations of theater ballistic missiles could release multiple warheads, and launch large volleys of theater missiles, the Airborne Laser's boost phase destruction is designed to avert this condition as well as provide defenses against longer-range intercontinental ballistic missiles.[129] By using an on-board, passive, 360-degree infrared sensor, the Airborne Laser will be able to perform autonomous detection, acquisition, tracking, and cueing.[130]

The Airborne Laser system will use a multi-megawatt chemical oxygen iodine laser on a Boeing-747 aircraft to destroy boosting missiles at ranges in excess of several hundred kilometers.[131] A proposed concept of operations is to use seven Airborne Laser aircraft, which would allow five aircraft to provide two combat air patrols (CAPs) in a theater. Two aircraft will be on patrol, two will be en-route, and one will be on ground alert, while the other two aircraft will be available for training or other purposes. The normal station time will be twelve hours, with a twenty-two-hour maximum, and airborne refueling will permit twenty-four-hour operations.[132]

Space Based Laser. The Space Based Laser (SBL) may provide both missile defense and space superiority role capabilities, though the

MDA sees it as principally contributing to defense in the boost phase, as well as a potential deterrent. The MDA is focusing on design validation and hopes to fly an on-orbit experiment to exhibit a lethal demonstration of SBL technologies by 2012.[133]

Kinetic Energy Concepts. The Missile Defense Agency plans to produce experiments in the 2003-2006 timeframe using kinetic kill concepts for destroying enemy missiles shortly after launch.[134] The goal is a kinetic boost phase defense capability in the 2006-2010 period, using either a sea-based or space-based platform. There is a possibility that testing may lead to an operational sea-based kinetic energy interceptor by 2006, however, numerous technical challenges remain. [135]

Preemptive, Deployment, or Counter-Force Segment

The Missile Defense Agency does not currently have a segment geared to attacking missiles and missile support assets before the boost phase, but may consider adding segments that address pre-launch attacks. Attack operations, and command and control, are likely to be critical components of such segments. Moreover, they are critical to integrate a layered missile defense concept. Attack operations makes-up the critical first layer while C2 and sensors are critical enablers throughout all the layers of missile defense -- from coordinating offensive time-sensitive-target attacks, interdiction of launchers, or strategic attack of missile facilities, to the final layer of terminal segment defenses.

Attack Operations. Attack operations are a joint capability, but one in which the U.S. Air Force has considerable influence, particularly through the command and control functions resident in the air operations center, platforms, sensors, navigation (Global Positioning System), and weapons.

The objective of missile defense attack operations is to prevent the "launch of theater missiles against U.S. forces, U.S. allies, other important countries, and other areas of vital interest."[136] Attack operations can also contribute to preventing future attacks by destroying launchers after one launch, but before reuse. To accomplish these objectives, attack operations can be divided into six key functional areas: intelligence, surveillance, and reconnaissance systems, BMC4I systems, strike systems, strike weapons, missile defense attack operations targets, and mission

assessment. Several military organizations are working to apply doctrine, strategy, tactics, techniques, procedures, testing, training, and exercises to advance the concept of attack operations and resolve time-critical targeting issues.

To serve as the focal point for attack operations for all of the military services and create a joint investment plan, the Joint Attack Operations Working Group was created. It divided attack operations into several activities to develop conceptual and investment strategies, including dealing with countermeasures and foliage penetration, in order to integrate attack operations and BMC4I.[137]

In the near-term, the concept of attack operations is to find, fix, track, target, engage, and assess mobile and fixed site missile systems and associated equipment, including such "strategic targets" as factories. In addition, interdiction targets, storage sites for enemy missile and weapons of mass destruction storage/maintenance sites, fixed and mobile command and control nodes, and supply-lines would be subject to attack as would pre- and post-launch theater missiles sites.[138] Inherent in the concept of attack operations is effects-based operations theory, which involves selecting targets whose destruction would have specific effects that result in second- or third-order levels of disruption, resulting in "control" of an adversary leader's decision making process, as opposed to traditional goals of attrition or annihilation.[139] While attack operations will not eliminate the missile threat, they will reduce the threat posed by missiles and weapons of mass destruction and thus reduce the options and power of an adversary leader to deter or disrupt U.S. operations.

Special Operations Forces (SOF) are also relevant to attack operations.[140] SOF relies on the ability to covertly insert forces, but they also typically integrate with the BMC4I system to find, fix, target, track, and assess theater ballistic missiles -- while retaining the ability to kill them, when required. With miniaturization and advances in communications technology, SOF attack operations will be improved by using more capable battle management systems, while faster or stealthier insertion methods would improve special operations forces capabilities. Furthermore, special operations activities well coordinated with aerospace power creates a synergy making either pre- or post-launch attack operations more effective.

Command & Control and Sensors. In addition to Airborne Laser and attack operations, the Air Force role in missile defense emphasizes

that Battle Management, Command, Control, Communications, Computers and Intelligence (BMC4I) is a necessary precondition for effective theater missile and cruise missile defense.[141] The Ballistic Missile Defense Organization defined the BMC4I role in terms of "early warning and dissemination, ensuring communications interoperability, and upgrading command and control centers."[142] Indeed, an ultimate goal of missile defense is to integrate systems and equipment, including sensors, interceptors, and tactical control centers, into a joint, layered missile defense architecture. Presently, the reorganized Missile Defense Agency considers battle management command and control, and sensors, key elements with missile defense architecture development. The Joint Air and Missile Defense Office is likewise actively engaged in developing operational concepts for command and control relationships, and joint system integration for missile defense in general, including some consideration of attack operations.

BMC4I systems can include uninhabited aerial vehicles (UAVs), and reconnaissance platforms such as the RF-16, EP-3, U-2, Joint Stars, Rivet Joint, Compass Call, Cobra Ball, and various other joint space, airborne, and ground assets. Attack and Launch Early Reporting to Theater (ALERT) provides warning of missile launches from sensors and improved cueing for theater defenses. Operated by the 11th Space Warning Squadron, ALERT relies on infrared data from the Defense Support Program satellites, as well as other assets, to identify missile launches.[143] Communications occurs through data links, most notably Link 16 and the Joint Tactical Information Distribution System, to provide connectivity between weapons and command and control systems.[144]

The Theater Air Control System provides rapid command and control for defending against missile launches and attacking other time-sensitive-targets. Some terms and systems are associated with the Theater Air Control System and directly relate to attack operations and theater missile defense. For example, dominant battlespace awareness is a goal of advanced BMC4I improvements that will help meet the Air Force goal of centralized control with decentralized execution of attack operations against ballistic missiles and time-critical targets.[145]

The Air Combat Command Combined Air Operations Center and integrating experiments build upon lessons learned in regional air operations centers, including Operations NORTHERN and SOUTHERN WATCH, over Iraq; Operation ALLIED FORCE; and Operation DESERT STORM. Now, Operation ENDURING FREEDOM is providing more

operational experience in integrating sensor and shooter functions that directly influence attack operations and thus will produce a more comprehensive future missile defense.

The Missile Defense Agency considers sensor suites and battlefield management command and control (BMC2) the "backbone" of the ballistic missile defense system and plans on developing these capabilities in parallel with other missile defense systems.[146] The Sensor Segment includes a variety of research and development projects to enhance ballistic missile detection, midcourse tracking, and discrimination through two primary projects: Space Sensors and International Cooperation.[147] However, multi-use sensors will have the capability for early warning, intelligence, and command and control for the spectrum of operations from attack operations to terminal phase missile defense. Yet, the command relationships to coordinate the many uses of these sensors have not yet been fully resolved. For example, joint publications reflect that the JFACC typically controls missile defense in theater.[148] But, as theater missiles are no longer recognized as a separate category, doctrinal ambiguity may occur over control of defenses and sensors, and allocation of attack operations, sensor, and C2 assets when a threat exists to both a theater and the United States itself.

The problems of allocation, command relationships, and use of resources, which are not yet resolved, are exacerbated when an adversary possesses a variety of long and medium range missiles. The Joint Air and Missile Defense Office is moving forward with an integrated missile defense concept of operations, now in the coordination stage, to attempt to address some of these concerns. However, the entire missile defense layered system and command relationships to control all the affected sub-systems are evolving.

Summary

As a result of the proliferation of missile technologies, weapons of mass destruction, and technologies that defeat detection, theater missile defense have become significantly more complex in the twenty-first century than it was when the Allies hunted for V-1 or V-2 missile sites during World War II. Since this situation will become more complicated as enemies improve their technological ability to thwart preemptive attacks and defensive measures, questions about persistent intelligence, communication, in-flight interception, and attack must be resolved.

Therefore, missile defenses must be highly redundant if they are to be successful, reinforcing the need for a joint, multi-layered approach for ballistic missile defense. Moreover, since short or mid-range missiles are the most likely near-term missile threat to U.S. interests, a multi-layered architecture and integrated command and control structure is necessary for force protection and defense of allies. In this construct, and likewise considering long-term concerns with intercontinental ballistic missiles in the hands of unfriendly states, attack operations remain a first, critical layer of that architecture.

IV. Missile Defense Options: Comparison and Analysis

The purpose of missile defense is to combine joint capabilities and balance passive missile defense, active missile defense, attack operations, and command and control into an integrated system that provides the most comprehensive protection against missiles to U.S. troops, allies, and the U.S. homeland. While this study focuses on active defense, attack operations, and command and control capabilities in the near-term; it is particularly interested in the use of pre-launch and post-launch attack operations. For planning purposes, Joint Publication 3-01.5 notes that intelligence preparation of the battlespace, joint theater missile defense preparation and training, operation planning, logistic requirements, and geographic considerations all affect missile defense planning.[149] Yet, it is also important to consider how range, cost, multi-mission capability, opportunity costs, environmental flexibility, and joint operations, among other considerations, influence various options for near-future missile defense.

Current and Near-Term Weapons Systems and Capabilities

The multi-layered missile defense system is lacking several key components over the next several years. Currently fielded and fully operational systems that could provide joint missile defense include various command and control assets, sensors, attack operations weapons platforms, and PAC-3. Unfortunately, the United States faces a near-term gap in its capabilities, particularly in missile defense during the boost and midcourse phases. The U.S. military, therefore, finds itself in the uncomfortable position of having a limited capability for attack operations and quite limited single-mission terminal weapons for missile defense in the near-term. This reality makes attack operations proportionally even more critical to bolstering overall near-term missile defense and anti-access capability.[150]

While the Patriot is the current weapon of choice for point defense, the U.S. currently does not have a rapidly deployable capability for active

area defense. Yet, the Air Force currently has some unique capabilities in command and control and attack operations. Therefore, attack operations remain the first layer of joint missile defenses, if used preemptively, and may be the *only* layer of missile defense available in certain situations. This may be especially true in scenarios where an enemy may seek to deny or deter the U.S. regional basing through the use of missiles when pre-deployed PAC-3 and C2 structures are not in place.

The anti-access threat is noteworthy given the deployment, operational limitations, and risks associated with certain point defense systems. The emerging Air Force global strike task force concept and other spearhead force concepts address this threat. At the same time, significant intelligence, surveillance, and reconnaissance capability is essential for locating missile launchers, command and control nodes, and support equipment.[151] Indeed, significant equities may be realized through joint participation, yet combined air operations center time-sensitive-target command and control experience provides a proven model for attack operations execution.

With respect to near-term capabilities, command and control is a missile defense priority for both the Missile Defense Agency and the Air Force. [illegible]h efficient command and control systems it will be possible to conduct successful DESERT STORM-style attack operations or ENDURING FREEDOM-style strikes against time-critical targets. While adequate battle management command and control translates into the destruction of transporter-erector-launchers after missiles are launched, superior command and control as well as intelligence, surveillance, and reconnaissance capabilities will be required if the U.S. military is to destroy significant numbers of mobile launchers before missiles are launched.

Comparison of Near-Term Systems

This section compares near-term theater missile defense and Air Force anti-missile systems, including attack operations, Patriot, and MEADS. It is important to note that attack operations provide the only near-term capability for attacking missiles on the enemy's side of the border, for preemptive or counter-force operations. The other current and near-term systems are terminal phase weapons, which are typically used in

point defenses, and are qualitatively evaluated in terms of attack operations (see Table 2).

Range. The most critical limitations of point defense systems are their stationary nature and limited range. Attack operations, whether executed by Special Operations Forces, information operations, or aerospace power, are preferable to relying upon only point defenses because attack operations destroys enemy theater ballistic missiles as far from friendly locations as possible. This is particularly important when dealing with weapons of mass destruction, because it is preferable to destroy these devices as far from friendly troops or cities as possible. Thus, point defense systems function as an important back-up layer of a multi-layered architecture, not as the *sine qui non* of missile defense.

Logistical Support. Logistical support for attack operations depends on basing rights, pre-positioning, and numerous other factors. While it takes time to resupply a terminal phase defense battery, keeping a relatively large flying unit operational requires substantially more personnel and supplies than does a single point defense detachment. The trade-off required to support an area defense capability (such as an air expeditionary wing with attack operations capabilities) involves calculating the cost, for example, of airlifting a fully equipped PAC-3 unit for the single mission of air defense. Prepositioning is also a logistical consideration, whether for a wing or missile battery. In the end, while an attack operations unit requires more sustenance support in terms of personnel, supply, munitions, fuel, and parts, it vastly increases the geographic coverage of the defense, and provides other inherent capabilities.

Cost. Cost is a particularly difficult characteristic to assess, particularly when one includes manpower, deployment, and sustainability costs as described in the logistical support section immediately above. In the case of comparing the costs of preemptive or area systems with more limited point defense systems, it is likely that the per unit/mile of coverage costs for attack operations are less than competing options.[152] Multi-use assets used in attack operations strikes, such as platforms, weapons, sensors, and C2, complicate an apples-to-apples comparison between joint systems.

Multi-Mission Capability. The multi-mission versus single mission question has plagued Air Force planners for decades. Likewise, attack operations and command and control overlap with other Air Force missions and joint endeavors. For example, fighter aircraft on a deep interdiction or attack mission might be rerouted while airborne to attack a transporter-erector-launcher, or support ground forces, or attack another target of strategic importance before completing the remainder of the pre-planned mission.[153] An E-3 Airborne Warning and Control System (AWACS) can control both an air superiority battle, while also enabling anti-missile Airborne Laser missions. Air Force attack operations (including Special Operations components) and battle management command and control systems are multi-mission capable. This is a distinct advantage and provides increased value over point air defense systems, including those which provide theater missile defense only, or those who must be reconfigured to defend against cruise missiles or aircraft.

Opportunity Costs. The opportunity costs for multiple missions represent one area of attack operations that significantly distinguishes Air Force operations and command and control from terminal defense systems. Given the overlapping nature of programs in current U.S. defense plans, it is difficult to identify all anti-missile specific attack operations and battle management command and control systems in the Air Force budget. However, nearly every fighter, bomber, electronic combat asset and platform, UAV, space asset, command and control network, and their associated personnel may potentially support joint missile defense and future Air Force anti-missile or anti-access programs. While single mission systems, such as the Patriot, provide a tactical capability, they divert resources from more capable multi-role systems.

Environmental Flexibility. While missile defense systems are designed to operate in diverse weather conditions, weather and terrain can reduce U.S. capabilities to attack or defend. For example, some airborne or space-based battle management command and control systems may be affected by solar storms and sandstorms, which in turn degrades the effectiveness of point defenses and attack operations. The Airborne Laser or space-based laser may also be affected by weather or atmospheric conditions. Thus, environmental factors must be considered when planning missile defense operations.

Joint Operations. Battle Management Command and Control represents the overarching requirement that spans the services and affects global theater missile defense and counter-proliferation efforts. The 1995 Roving Sands exercise provided an opportunity for the military services to conduct effective attack operations with BMC4I. The 1997 Joint Project Optic Windmill-2, a joint and combined theater missile defense assessment with Dutch, German, and U.S. forces, was another.[154] JTAMDO has conducted numerous exercises and plans to execute more as they develop doctrine for an integrated, layered missile defense and attack operations.[155] Future integration of Navy, Marine, Army and Special Operations Forces into attack operations to protect allies with joint U.S. missile defense systems is a high priority and is likely to remain so to joint force commanders.

Limitations. Weather conditions can limit the effectiveness of missile defense systems, just as terrain reduces the efficiency of bomb-dropping attack operations, communications, and overhead surveillance. However, range is a more significant limitation for point defense systems because lower tier systems, as the last form of defense, intercept missiles virtually over the heads of those whom they are positioned to protect. Thus, the short effective range of the defending missile systems has significant political and military implications, particularly if theater ballistic missiles are armed with weapons of mass destruction.

Currently, Air Force battle management systems are able to effectively execute all-weather attack operations against fixed missile launch and support facilities as well as typical post-launch mobile targets that are farther away from friendly forces or population centers. However, the level of interoperability limits all tiers of missile defense despite progress in defensive capabilities over the near and mid-term. Finally, territorial use and overflight treaties may limit ground-based systems, while constraining the areas from which attack operations may be launched, although global attack offers some promise for long-range attack operations. Weapons accuracy and collateral damage concerns may also potentially serve as an operational limitation. Additionally, if there is no suitable ocean nearby a conflict region, U.S. Navy and Marine missile defense assets might also have limited value.

Preparation and Training. Single mission systems require dedicated personnel and training. Attack operations training for Air Force units typically relates to interdiction or defensive counterair roles, while time critical targeting may require additional training and improvements in data link technology. Battle management systems require extensive training, but these are multi-use and overlap with intelligence, surveillance and reconnaissance requirements and systems. The near-term lower tier systems take personnel from other mission areas and apply them to specific air defense missions with no offensive capability.[156]

Operational Planning. Both attack operations and BMC4I require pre-mission planning for relocating C4I assets, programming specific weapons for attack platforms, and developing theater-wide familiarity for crews who operate over enemy territory. Planning requirements, however, are consistent with training at the tactical or individual units levels. At the operational or strategic planning level, attack operations are a doctrinal task that is part of offensive counterair, air interdiction, and strategic attack efforts. However, interoperability at the joint level is required, particularly for joint weapon engagement zones and for the rules of engagement for lower tier air defense systems, and this is where air power platforms must operate.[157]

Deployment Speed. Most Air Force attack operations and battle management systems can be deployed rapidly. With minimal airlift support in comparison with ground forces, an on-call Air Expeditionary Wing can deploy and be ready for combat operations within hours.[158] Forward prepositioning of munitions and fuel as well as agreements for landing and operating rights facilitate the deployment speed of expeditionary forces. In contrast, lower tier systems often are not in the prepositioned location, and thus require numerous airlift sorties before a significant defensive capability is achieved. Furthermore, aerospace forces can employ from the continental United States directly to worldwide bases when executing global attack sorties, retargeting in flight.

Political and Geographic Considerations. Political conditions may influence maintaining an attack operations base, as exemplified by limitations on employing air power when forces are based in Saudi Arabia. Given the inherent range limitations associated with lower tier systems,

defending large geographic areas is difficult given the danger that weapons of mass destruction could detonate near friendly troops or population centers. Although attack operations create large areas of operations, their defensive nature may make point systems more politically satisfactory.[159]

Summary

As shown in Table 2, MEADS and perhaps a follow-on to Navy Area may be available to supplement PAC-3 in the next several years. However, attack operations and BMC4I will provide the largest capability for adding another layer before relying on terminal defense systems. This would emphasize a proactive missile defense, and not simply target missiles potentially over the heads of friendly forces or allies. Since the deployment of the THAAD, airborne laser, and Sea-based Midcourse System (successor to Navy Theater Wide) is not anticipated before 2005, these systems are not examined in detail.[160]

Implications

Although missile defense pundits occasionally note the importance of attack operations, there is not a comprehensive and integrated plan for improving current operations, systems, and doctrine. Many military commanders and senior military officers, including those in the Air Force, recognize the value of attack operations, particularly with regard to improved command and control and time-sensitive-targeting, or attacking mobile targets. Attack operations, however, represent an under-advertised capability, which implies that future funding for advancing attack operations will be limited in comparison with the core activities of the Missile Defense Agency. Indeed, evidence indicates that the agency currently does not emphasize attack operations in a pre-launch segment and there is no significant breadth of joint or Air Force doctrine specifically emphasizing integrated attack operations.

Categories	Preemptive or Counter-force Segment		Terminal Segment	
	Attack Ops Pre-launch	Attack Ops Post-launch	Patriot	MEADS
Range	+	+	-	0
Logistic Support Required	-	-	-	-
Multi-Mission Capability	+	+	0	0
Opportunity Costs	+	+	-	-
Environmental Flexibility	+	+	+	+
Joint Environment Functionality	+	+	0	+
Limitations	0	+	-	-
Preparation and Training	+	+	-	-
Operation Planning	+	+	-	-
Deployment Speed	+	+	-	-
Political Geographic Considerations	+	+	-	-

Legend:
"+" Denotes superior capability, a positive comparative advantage based on preceding analysis.
"0" denotes no significant comparative advantage.
"-" Denotes negative comparative advantage.

Table 2: Comparison of Near-Term Joint Missile Defense Systems

To some, the conventional wisdom holds that attack operations are relatively ineffective, and that more money should be invested in purely defensive systems. However, attack operations provide an essential capability -- a critical first layer-- in any system of integrated missile defenses. Given that the Secretary of Defense recognized and reorganized based on the assertion that a multi-layered system of systems is the best approach to the missile threat, it is important to note that attack operations *are* that first layer. As with other incarnations of defense against air threats, the well worn metaphor that hitting the "eggs in the nest" is truly more economical than throwing stones at one flying bird at a time, still rings true. Furthermore, improving command and control, as well as sensors, makes attack operations more effective than it was in World War II or Operation DESERT STORM. Given growing interest in preemptive ballistic missile attacks, concerns about weapons of mass destruction, and the limited ability of point defensive systems to protect targets, attack operations have become increasingly important in the near-term. Thus, it is imperative to improve the ability of attack operations with additional training and funding to respond to operational demands.

Finally, there is the inherent conflict between how land forces think about "defense" and the airman's view that aerospace power is *best used offensively*. While this conflict is unlikely to be resolved tomorrow, resolving these doctrinal debates will improve the ability to conduct efficient and integrated command and control, and attack operations. Fortunately, many service and joint agencies are entering this doctrinal, and perhaps programmatic, debate. Yet, although the U.S. missile defense regime is now moving toward in integrated, multi-layered continuum of offensive and defensive anti-missile systems and actions, there are limited point defenses, and there are no national or area defenses, today. Attack operations and time-sensitive-targeting techniques and technologies are definitely critical to an effective, proactive missile defense system -- today and in the future.[161]

V. Conclusion

The principle goal of this study was to promote attack operations as the critical first layer in a layered missile defense regime to defeat anti-access and missile threats. This study concludes with four specific actions or options that are likely to improve the Air Force contribution to the ability of the United States to defend against ballistic missiles.

First, the Air Force should establish a standing capability within its Air Expeditionary Forces for conducting attack operations, and time-sensitive-targeting. This capability would serve multiple purposes, including operations against ballistic missiles, mobile targets, and weapons of mass destruction, as well as conventional time-sensitive-targeting missions and other strike efforts. This approach builds on assets that are capable of conducting multiple missions, but require additional training, equipment, or further specialization if these are to provide an effective option for conducting offensive missions against missiles and other time-sensitive-targets.[162]

An anti-access task force or a standing capability within the on-call wings would provide a model or perhaps an operational experiment with this concept. For example, tasking specific Air Force Guard and Reserve units, and on-call wing units, for attack operations missions would give those units a primary or secondary responsibility for conducting attack operations during training and combat. Furthermore, training as part of an Aerospace Expeditionary Force or Air Expeditionary Wing, a multi-role force that is tailored and trained for attack operations, would give the United States a significant standing operational capability. This could be accomplished by simply emphasizing training and systems required to conduct time-sensitive-targeting for certain squadrons in the on-call air expeditionary wings. Before becoming an operational capability, these units could validate their capabilities through Red Flag or other exercise venues. Such a tailored Aerospace Expeditionary Force concept would not conflict with current Air Force doctrine or Joint Publication 3-01.5. Finally, training and maintaining units within the AEF structure would be possible by assigning squadrons with a time-sensitive-targeting or attack operations secondary or tertiary mission in their wing's mission statements.

An additional benefit to this capability is that an expeditionary unit that has trained specifically for attack operations and time-sensitive-targeting may have sufficient offensive power to deter states from launching ballistic missiles. However, the capability would have to be communicated to potential adversaries to have a deterrent or dissuasive effect. Its operational value would rest on its rapid response capability, deterrent capability, and ability to destroy missiles and weapons of mass destruction on the enemy's side of the border. Moreover, effectively destroying missiles armed with weapons of mass destruction with precision and advanced weapons capabilities may also limit collateral damage to military facilities and urban areas.

As F-22s become operational, U.S. force capability will improve, but there will still be a threat to forward based (land or sea) forces due to ballistic missiles. The Global Strike Task Force concept will provide a capability to mitigate the initial anti-access missile threat by using long-range and stealthy precision attack to suppress initial missile threats. The F-22 will also be extremely valuable in an attack operations role, as part of a spearhead force performing counter air, and attack operations, missions. It will permit daylight stealth strikes for attack operations or other offensive missions. Subsequent mobile or fixed missile threats could be suppressed throughout a time-phased deployment of an anti-access spearhead (wing, group, or task force), in conjunction with significant intelligence, surveillance, and reconnaissance assets, if deployed preceding the weight of the follow-on forces.

Second, the Air Force should consider establishing an anti-missile office having overall responsibility for and oversight over all USAF force planning, programming, doctrine, and integrating efforts for missile defense issues. At present, the two joint organizations that are tasked with theater missile defense duties are the Missile Defense Agency and the Joint Air and Missile Defense Organization. By contrast, the air staff considers attack operations concepts; oversees the airborne laser program; oversees or participates in theater missile defense procurement, sensor and command and control integration, and space based laser development; and is involved discussions about operational strategy through several air staff offices. While the Air Force provides most BMC4I and attack operations technologies and platforms, other agencies manage different components of the Air Force BMC4I architecture. Finally, numerous directorates and command staffs, including Air Combat Command, are developing

concepts of operations and doctrine for the Air Force and the military services.

However, as these examples suggest, there is no *single* senior Air Force leader, below the Chief of Staff, who organizes, trains, equips, oversees, and coordinates all Air Force plans for missile (or air and missile) defense. No one is responsible for integrating all programs and doctrine from concept to acquisition to employment. A general officer that is tasked with this integration of plans and systems for missile defense would be better positioned to blend effects based operations concepts with joint attack operations and adjudicate doctrinal and funding differences with the other military services. Though establishing a separate directorate beneath the Deputy Chief of Staff Air and Space Operations (XO), would be an expedient solution, wherever located, this officer would need to coordinate between several XO and Deputy Chief of Staff for Plans and Programming (XP) directorates. The key XO coordination offices would include the Director of Command and Control (XOC); Intelligence, Surveillance, and Reconnaissance (XOI); Homeland Security (XOH); Operations and Training (XOO); Operational Requirements (XOR); and Space Operations and Integration (XOS). The key XP directorate offices would include the Directorate of programming (XPP) and the Directorate of Strategic Planning (XPX). Additionally, USAF Acquisition (AQ) would remain a significant office for program development and Air Combat Command produces concepts of operations while the AF Doctrine Center coordinates doctrine development. With the need to harmonize efforts of these Air Force offices, as well as JTAMDO, the Office of the Secretary of Defense, the Joint Staff, and the Missile Defense Organization, and perhaps scientific and test communities, the portfolio of this single officer would be significant. Yet, to advance a coordinated attack operations and time-critical-targeting capability, a synchronizing directorate or office appears warranted.

Third, the Air Force can improve how it conducts attack operations in the near-term, by advancing attack operations, time-sensitive-targeting, and BMC4ISR (including surveillance and reconnaissance) capabilities for multi-layered, joint theater missile defense plans. A principal reason that the basic Air Force attack operations philosophy exceeds joint doctrinal limitations is that attack operations overlap numerous elements of Air Force doctrine. Attack operations might involve striking enemy missile launch or repair facilities, command and control nodes, or other associated dual use sites. In addition, the Air Force has considerable experience with

attack operations, time-sensitive-targeting, fusing surveillance and reconnaissance data through an air operations center, using command and control, and coordinating disparate platforms and weapons into offensive action. In view of the political determination to create effective multi-layered theater missile defenses to counter weapons of mass destruction, a logical step for the Air Force is to focus on improving attack operations.[163] More investment in command and control, time-sensitive-targeting, and air operations center development, will further attack operations effectiveness, and thus provide a better first layer of missile defense. Moreover, attack operations should be integrated, defined, and its doctrinal theory more definitively stated in core Air Force doctrine documents. This may also provide weight to arguments that the MDA should provide additional funding for AF sponsored joint attack operations efforts.

Fourth, the U.S. military should promote change in joint doctrine to reflect the fact that attack operations are offensive missions. The central concept should be that missile defense includes offensive, defensive, and BMC4I activities, all of which have implications for interdiction and strategic attack. In essence, attack operations are not strictly a "defensive" activity regardless of the emphasis given by Joint Publication 3-01.5. Indeed, the decision to attack enemy assets in enemy territory is an inherently offensive operation, and in the case of weapons of mass destruction, attack operations involve both deterrence and destruction.[164]

This is not simply an Air Force issue. Joint doctrine states that the joint force commander will typically select the air component commander to direct attack operations as well as the support other component commanders in their attack operations efforts.[165] Since the nature of air power and attack operations is offensive, airmen will be better able to understand how attack operations influence the air campaign and, when appropriate, the ground-force battle plan. Since attack operations assumes a joint character, there is a fundamental need for joint doctrinal agreement. Allocation and target selection priority must be negotiated in a joint environment, weighing and prioritizing long-range threats to the U.S. and allies with shorter range threats to fielded U.S. and allied forces or friendly population centers. Phasing too will be a consideration, particularly what weight of effort will attack operations take in each phase, and how that is coordinated with point missile defense systems, such as the Patriot, and area defenses, such as the Airborne Laser or Ground Based Midcourse. These factors and the command relationships when a missile threat spans

regional commander in chief areas of responsibility, defense of the United States, and weapons of mass destruction.

Increasing the influence of Air Force doctrine in the layered joint missile defense concept will have significant benefits. This will include a focused concept of the use of offensive air operations in a missile threat environment; an increased awareness of proactive attack operations, and its relationship to reactive missile defense systems; and better visibility in Congress for funding of attack operations, BMC4I, and the F-22. Increasing the level of visibility, in this case through establishing a more accurate joint doctrine document on missile defense and attack operations, is likely to generate additional funding priority for air and missile defenses.[166]

In conclusion, the proliferation of ballistic missiles, anti-access threats, and weapons of mass destruction creates new operational and technological challenges for the country. In the multi-layered missile defense paradigm, attack operations, striking enemy missile and missile support facilities before or after missile launch, is an essential first layer of defense. A joint attack operations capability, and the long history of Air Force experience with the mission, provides an effective means to reduce an enemy missile threat through a measured, aggressive, and increasingly effective offense. Likewise, technological advances are reducing the time between when a sensor detects a missile and the time that a weapon could destroy that missile by increasing command and control and sensor capabilities. In this strategic and technological environment, the ability of the Air Force to conduct more effective attack operations, and to deny an enemy sanctuary, will only increase over time. The Air Force must promote the capability to conduct credible attack operations and defeat a missile, anti-access, or weapons of mass destruction threat, as far from friendly forces or territory as possible. The result will be that the United States will have increased its ability to project military power while simultaneously protecting U.S. troops, allies, and the American homeland.

Appendix: Reviewing Options for Missile Defense

The tables on the following pages summarize the advantages and disadvantages of the missile defense proposals that are outlined in the Chapter V--Conclusion.

Implication	Pros of a USAF Missile Defense Office	Cons of a USAF Missile Defense Office
Limited funding requires the need for multi-role capability.	A single USAF MD leader will be able to better present unified USAF MD concepts in efforts to gain funding. Can coordinate with the entire USAF regarding force structure and employment issues to ensure continuity.	Additional duty and requirement for a general officer. Structural organizational changes must not allow increased bureaucracy.
The importance of having an effective, flexible, and exceedingly deployable anti-missile option will increase as the threat, particularly the WMD threat, proliferates.	A single leader will not enable better immediate employment but will allow easier coordination for field commanders because of better integration and systems effectiveness.	N/A
Training for attack operations and joint BMC4I interface is required	USAF testing and exercises could be integrated for attack operations and BMC4I more easily.	N/A
Doctrinal friction between land force concepts of defense and the USAF nature of offensive airpower will continue.	A single voice coordinating USAF MD efforts can only help articulate the USAF philosophy on the employment of airpower.	N/A

Table 3: Establishment of an Air Force Anti-Missile Office

Implication	Pros of Attack Operations/Anti-access Task Force or Expeditionary Unit Capability	Cons of Attack Ops/Anti-access Task Force or Expeditionary Unit Capability
Limited funding requires the need for multi-role capability.	Established Expeditionary Unit Capability. Full multi-role capability. Funding is available for BMC4I improvements through Missile Defense Agency that will help attack operations Expeditionary Unit Capability. Incorporating Air Guard and Reserves could reduce operations tempo and increase capability for similar funding.	Integration funding may not be readily available. Misperception of attack operations Expeditionary Unit Capability as a separate unit and not able to fold into an AEF when required.
The importance of having an effective, flexible, and rapidly deployable anti-missile option will increase as the threat, particularly the WMD threat, proliferates.	Anti-access Task Force is capable of rapid deployment. With training and BMC4I integration, effectiveness will increase. Anti-access Task Force provides additional joint attack operations option. Passive defense can easily be incorporated with Anti-access Task Force.	Deterrent effectiveness is dependent upon a coordinated diplomatic/political/information effort. Superior destruction potential requires effective ISR and BMC4I. Attack operations will require some active defense at some time in a high threat environment.
Training for attack operations and joint BMC4I interface is required.	Established (and improving) attack operations training and tactics exist. Training can dovetail with current Red Flag, Green Flag, and other exercises. Unit level training can be supplemented by training with units together (e.g., short temporary duty trips for E-8 JSTARS to operate with an F-15E unit on an attack operations practice session).	Additional training may require additional funding.
Doctrinal friction between land force concepts of defense and the USAF nature of offensive airpower will continue.	N/A	N/A

Table 4: Anti-Missile/Anti-Access Attack Operations/Anti-Access Task Force or Expeditionary Unit Capability

Implication	Pros of Emphasizing Improving and Employing Attack Operations	Cons of Emphasizing Improving/Employing Attack Operations
Limited funding requires the need for multi-role capability.	All attack operations assets have a multi-mission capability as evidenced by the fact that attack operations incorporate the function areas of offensive counterair, interdiction, and strategic attack. The same assets that conduct attack operations can conduct other missions, sometimes on the same sortie. Current and planned near-term munitions will be effective for the attack operations and attack operations for WMD specific missions.	To improve attack operations, beyond the funding for BMC4I, additional money and manpower is required to provide rapid and significant increases in ability. Speeding deployment of new weapons systems is required to provide better all weather attack operations capabilities.
The importance of having an effective, flexible, and exceedingly deployable anti-missile option will increase as the threat, particularly the WMD threat, proliferates.	Attack operations are both rapidly deployable and effective. The BM/WMD threat is increasing and attack operations are the only consistent across border anti-missile capability we possess. With training and BMC4I integration, effectiveness will increase. Anti-access Task Force provides additional joint attack operations option. Passive defense can easily be incorporated in a future joint task force.	Attack operations are not 100% effective. Preemption may be perceived as inflammatory. Post-launch counter-force requires absorbing a first strike.
Training for attack operations and joint BMC4I interface is required.	Established (and improving) attack operations training and tactics exist. Training can dovetail with current exercises. Unit level training can be supplemented by training with units.	Additional training may require additional funding, particularly if additional equipment is required.
Doctrinal friction between land force concepts of defense and the USAF nature of offensive airpower will continue.	N/A	N/A

Table 5: Improve and Employ Attack Operations

Implication	Pros of Changing Joint Doctrine	Cons of Changing Joint Doctrine
Limited funding requires the need for multi-role capability.	Doctrine is linked to perceptions, and perceptions are certainly linked to funding. Therefore, increasing the perceived USAF attack operations contribution may lead to increased funding—which then leads toward better and more capable U.S. military anti-missile efforts.	Long, hard doctrinal fight. Entrenched surface service influence in the current iteration of JP 3-01.5, emphasizing point defenses.
The importance of having an effective, flexible, and exceedingly deployable anti-missile option will increase as the threat, particularly the WMD threat, proliferates.	Consistent doctrine provides both a baseline and a point of departure for rapid and effective operations. Easier for JFACC to rapidly organize and administer air defense. A unified front of anti-missile military action is more productive than a broad-brush, defensive posture.	N/A
Training for attack operations and joint BMC4I interface is required.	Re-engaging doctrinal discussions reinvigorates training, making better use of time and resources. Easier for JFACC to organize and administer air defense.	N/A
Doctrinal friction between land force concepts of defense and the USAF nature of offensive airpower will continue.	Encouraging doctrine discussions leads doctrine from dogma to functional, useful doctrine. Doctrine should evolve with capabilities. As attack operations and BMC4I are the only offensive anti-missile capabilities, current doctrine should be reevaluated.	Possible perceptions of "rice-bowl" fights for funding. Threat of overselling attack operations—it is not 100% effective, like all military operations.

Table 6: Change Joint Doctrine

Notes

[1] The anti-access threat is a mix of political, geographic, and military concerns that might prevent the U.S. from effectively projecting power overseas or by increasing the risk of operating from forward locations.

[2] Joint Publication (JP) 3-01.5, Doctrine of Joint Theater Missile Defense, February 22, 1996. "Attack operations are characterized by offensive actions intended to destroy and disrupt enemy TM [theater missile] capabilities before, during, and after launch…The objective of attack operations is to prevent the launch of TMs by attacking each element of the overall system, including such actions as destroying launch platforms, reconnaissance, surveillance, and target acquisition platforms, C2 [command and control] nodes, and missile stocks and infrastructure. Attack operations also strive to deny or disrupt employment of additional TMs that may be available to the enemy. The preferred method of countering enemy TM operations is to attack and destroy or disrupt TMs prior to their launch."

[3] The Scud is a theater ballistic missile, initially of Soviet origin, that has proliferated to third world nations as a relatively inexpensive terror weapon. The Scud is capable of delivering weapons of mass destruction.

[4] Ballistic Missile Defense Organization, "Ballistic Missile Defense Organization Funding," 2001 Submit, available on-line at http://www.acq.osd.mil/BMDO/bmdolink/pdf/budget.pdf, 14 March 2002. While there are multiple sources for the specific funds spent on missile defense systems, studies, and research programs, this source summarizes specific Ballistic Missile Defense Organization projects in terms of procurement, research and development, and military construction.

[5] The term "family of systems" is a term used by the Ballistic Missile Defense Organization, forerunner to the Missile Defense Agency, to describe the multi-layered architecture of planned missile defense systems. Multi-layered implies more than a single defense system, perhaps defense systems that are effective in different phases of the missile's flight.

[6] Missile Defense Agency, MDA Link, *The Ballistic Missile Defense System*, available on-line at http://wwwacq.osd.mil/bmdo/bmdolink/html/system.html, 13 March 2002.

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[7] Missile Defense Agency, MDA Link, *Ballistic Missile Basics*, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/html/basics.html, 14 March 2002.

[8] The MDA segments are the boost, mid-course, and terminal. This paper adds a pre-launch segment for discussion.

[9] Keeter, Hunter, "Service Officials: Navy Terminal-Phase Missile Defense Remains a Requirement," *Defense Daily International*, Potomac, MD, Jan 25, 2002. The USN canceled the point-defense Navy Area program 14 December 2001 but retained the Navy Theater Wide program under the direction of the newly reorganized Missile Defense Agency. The Navy Theater Wide program is evolving into the "sea-based mid-course" system, which will be part of the new, layered defense concept currently promoted by the MDA.

[10] *Air Force Doctrine Document 1 (AFDD-1)*, September 1997, pp. 46-51. "*Counterair* consists of operations to attain and maintain a desired degree of air superiority by the destruction or neutralization of enemy forces…This function consists of operations to destroy, neutralize, disrupt, or limit enemy air and missile power as close to its source as possible and at a time and place of our choosing. OCA operations protect friendly forces and vital interests by destroying or neutralizing enemy offensive air and missile threats before they bring their effects to bear against us…. *Interdiction* consists of operations to divert, disrupt, delay, or destroy the enemy's surface military potential before it can be used effectively against friendly forces…*Strategic attack* is defined as those operations intended to directly achieve effects by striking at the enemy [centers of gravity]…However, the determining factor is that strategic attack should affect the enemy's entire campaign rather than just a single action, battle, or campaign."

[11] Fogleman, General Ronald R., "The Air Force Role in Theater Ballistic Missile Defense," remarks delivered to the American Defense Preparedness Association/National University Foundation Breakfast Seminar Series on Missile Defense, Counter Proliferation, and Arms Control, Washington, D.C., June 16, 1995.

[12] Ballistic missiles produce some air power effects, such as deterrence, long-range attack capability, WMD delivery systems, etc. In effect, theater ballistic missiles provide some of the capabilities of a more

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robust air force for much less investment. Therefore, they are desirable to regimes with little money and a desire to have strategic military impact.

[13] Werrell, Kenneth P., The *Evolution of the Cruise Missile*, Air University Press, Maxwell Air Force Base, Alabama, September 1985, p. 7. Warrell provides an historical development of the cruise missile concept in his well-referenced book. Peter C. Hewitt is cited with approaching Elmer C. Sperry with the "flying bomb" idea in 1915. This is recorded in a report by Bion J. Arnold to the Secretary of War, "Secret Report on Automatic Carriers, Flying Bombs (FB), Aerial Torpedoes (AT)," January 31, 1919 (AUL-623.451 W253B).

[14] *United States Strategic Bombing Survey (USSBS)*, Vol. 60, Military Analysis Division, Washington D.C., 1945, pp. 26-27.

[15] Ibid. p. 4.

[16] Ibid, Vol. 2, p. 88, and Vol. 60, p. 5. In *The Evolution of the Cruise Missile*, pp. 60-61, Warrell reports that the Germans fired 10,492 V-1s against Britain and up to another 9,000 against targets on the continent. He cites the *USSBS, Aircraft Factory Division Report*, p. 115, (AFSHRC-137.302-3) when he notes that the Germans built approximately 30,000 V-1s with 60,000 planned.

[17] Eisenhower, General Dwight D., Crusade, Doubleday Publishers, New York, New York, 1948, p. 260.

[18] Indeed, William "Billy" Mitchell and J.F.C. Fuller advocated, at various times, the use of weapons of mass destruction, notably poison gas in World War I, against cities to affect a population's will to fight and thereby limit total casualties. It should be noted that the author of this occasional paper does not support or advocate attacks directed against civilians, conventional or otherwise.

[19] Warrell, Kenneth P., *The Evolution of the Cruise Missile,* p. 44. While numerous sources provide similar statistics, it is obvious, regardless of the exact number of sorties, that the Allies expended considerable effort attacking German V-weapon launch sites during Operation CROSSBOW.

[20] *Ibid*., p. 49.

[21] *The Proliferation Primer*, Committee of Governmental Affairs, United States Senate, Washington D.C., January 1998, p. 57.

[22] *United States Strategic Bombing Survey (USSBS)*, Vol. 60, Military Analysis Division, Washington D.C., 1945, Vol. 60, p. 23.

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[23] Kipphut, Lieutenant Colonel Mark, "Theater Missile Defense: Reflections for the Future," *Air Chronicles,* p. 4; and *United States Strategic Bombing Survey (USSBS)*, Vol. 60, pp. 2-4. He also used the term "*qualified success*." Additionally, Neufeld, Michael J., *The Rocket and the Reich* The Free Press, New York, New York, 1995, discusses the impact of attack operations on the V-2 program. This study details the dispersal required by air attacks, the slave labor conditions that the Nazi state used to build V weapons, and thus that attack operations affected V weapon production and employment.

[24] Wolf, Richard I., *The United States Air Force Basic Document on Roles and Missions,* Office of Air Force History, Washington D.C., 1987, p. 91. *Section IV* of the *Army-Air Force Implementation Agreements*, September 15, 1947, defined which service controlled what missiles. Additionally, AAA and training were discussed in this section. Wolf provides commentary, much of which is cited from Futrell, Robert F., *Ideas, Concepts and Doctrine: A History of Basic Thinking in the United States Air Force 1907-1964* Air University Press, Maxwell Air Force Base, Alabama, 1974. Wolf provides the text of the original agreements and memoranda.

[25] *Ibid*., p. 207.

[26] *Ibid*., pp. 207-220.

[27] *Ibid*., pp. 219-220.

[28] Neufeld, Jacob, *Ballistic Missiles in the United States Air Force 1945-1960* Office of Air Force History, Washington D.C., 1990, pp. 87-89. Some key points agreed upon in the 1952 service roles negotiations include: Neither service would try to modify the other's roles and missions; the terms "tactical" and "strategic" would not constitute a specific range; surface-to-air weapons used as either extended or supporting artillery remained the Army's responsibility; the Air Force would not oppose Army development of missiles for low altitude surface-to-air interception; missiles that would replace fighter interceptors were the responsibility of the USAF; and battlefield isolation and interdiction of movement were Air Force functions.

[29] The "X" designation typically indicates an experimental aircraft while the "F" designation indicates fighter aircraft. It is noteworthy that

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the Bomarc was apparently considered an "experimental fighter" at the time, based on its designation, but was unmanned.

[30] Gibson, James Norris, *The History of the U.S. Nuclear Arsenal*, Brompton Books Corporation, Greenwich, Connecticut, 1989, pp. 165-166.

[31] *Ibid*., pp. 153-4. The Regulus II was the only supersonic surface-to-surface cruise missile developed by the U.S. Navy.

[32] *Ibid*., p. 167.

[33] U.S. Army Ordnance Missile Command, *Nike Ajax*, Historical Monograph, Redstone Arsenal, Alabama, July 1, 1962, p. 3.

[34] Neufeld, Jacob, *Ballistic Missiles in the United States Air Force,* pp. 18-21.

[35] Gibson, James Norris, *The History of the U.S. Nuclear Arsenal*, pp. 172-174.

[36] *Ibid*., pp. 168-170.

[37] Neufeld, Jacob, *Ballistic Missiles in the United States Air Force 1945-1960*, pp. 143-149.

[38] *Ibid*., pp. 271-313. The appendices included by Neufeld contain detailed memoranda concerning the early arguments over missile policy and administration.

[39] *Ibid*., pp. 167-180.

[40] Ballistic Missile Defense Organization, *Missile Defense Milestones,* http://www.acq.osd.mil/Ballistic Missile Defense Organization /bmdolink, December 2, 1997.

[41] Gibson, James Norris, *The History of the U.S. Nuclear Arsenal*, pp. 170-172.

[42] Ballistic Missile Defense Organization, *Missile Defense Milestones*.

[43] *Ibid*.

[44] *Ibid*.

[45] "Treaty On Principles Governing The Activities Of States In The Exploration And Use Of Outer Space, Including The Moon And Other Celestial Bodies," available on line at http://www.state.gov/www/global/arms/treaties/space1.html, 22 April 2002.

[46] For treaty and perhaps other reasons, theater missile defense technologies were pursued separately from national missile defense.

[47] Ballistic Missile Defense Organization, *Missile Defense Milestones*.

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[48] Cohen and Keaney, *Gulf War Air Power Survey Summary Report*, p. 83 and Gordon, Michael R., and Trainor, General Bernard E., *The Generals' War*, Little, Brown and Company, Boston, Massachusetts, 1995, p. 228.

[49] Cohen and Keaney, *Gulf War Air Power Survey Summary Report*, p. 43.

[50] Gordon and Trainor, *The Generals' War*, p. 229.

[51] Cohen and Keaney, *Gulf War Air Power Survey Summary Report*, p. 17.

[52] Gordon and Trainor, *The Generals' War,* p. 230. "… the Pentagon knew it had a big problem on its hands. In the inner councils of the Bush administration, no problem worried officials more than what might happen if Israel entered the war…"

[53] Cohen, Eliot A., and Keaney, Thomas A., *Revolution in Warfare? Airpower in the Persian Gulf War,* Naval Institute Press, Annapolis, Maryland, 1995, pp. 14-15. These well known authors assert that there is little direct evidence the Scud attacks were successful, however, there is data supporting a reduction in missile launch frequency once the Scud Hunt began.

[54] Major General Corder, author interview, September 18, 1997. General Corder's discussion of Dynamic Battle Control, as required in the concept of operations for the attack of time-critical-targets, is explored in more detail in this study. "Near real time, near perfect picture" is a frequently cited desire for C4I and integration for various airpower functions, including attack operations.

[55] Cohen and Keaney, *Gulf War Air Power Survey Summary Report*, pp. 88-90.

[56] See Postol, Theodore A., "Lessons of the Gulf War Experience with Patriot," *International Security*, Winter 1991/92, pp. 191-202, for the argument that Patriot surface-to-air missiles did not successfully defend against Scud attacks.

[57] Jacky, Jonathon, *An Analysis of the Gulf War One Year Later*, CPSR Newsletter, Volume 9, Number 4, Fall 1991.

[58] In the case of weapons of mass destruction, the theater ballistic missile debate suggested that the political dimension of missile employment is as critical as it was during World War II.

Notes

[59] Ballistic Missile Defense Organization, *Missile Defense Milestones*.

[60] BMC4I is frequently interchanged with the acronyms C4I, C3I and BM/C3I in various missile defense publications and speeches. In this study, the term "BMC4I" includes all non-attack technologies and issues revolving around the collection and interface arena with respect to ballistic missile defense. General Ronald R. Fogleman used this term in his presentation, "The Air Force Role in Theater Ballistic Missile Defense." Furthermore, the Ballistic Missile Defense Organization used the term BM/C3I on its web site, available on line at http://www.acq.osd.mil/Ballistic Missile Defense Organization /bmdolink/html/tmdccc.html. The Air Combat Command (ACC) uses the term C4ISR to denote adding surveillance and reconnaissance. Presently, the Ballistic Missile Agency uses the term BMC2, which when combined with sensors, will become the "backbone" of the ballistic missile defense system. See Missile Defense Agency, *The Ballistic Missile Defense System.*

[61] Ballistic Missile Defense Organization, *Missile Defense Milestones*.

[62] The tests mentioned herein do not represent an inclusive list of USAF or joint programs.

[63] An example of a direct attack might be a fighter dropping a bomb on a mobile missile launcher, destroying the missile itself. An example of an indirect attack might be a Tomahawk missile destroying a storage center of missile guidance computers—no missile is directly destroyed, but their future use is hampered through the attack.

[64] News Release, *Joint Theater Air Missile Defense Organization*, (Reference Number: No. 021-97, Office of the Assistant Secretary of Defense for Public Affairs, January 16, 1997).

[65] Undersecretary of Defense (Acquisition and Technology) and Vice Chairman of the Joint Staff Directive, 14 Nov 1996.

[66] J-8 is the Joint Staff's Director for Force Structure, Resources, and Assessment. The Joint Theater Air and Missile Defense Organization was functionally located under this directorate, the Joint Air and Missile Defense Organization is now under J8 too.

[67] Department of Defense, *Quadrennial Defense Review Report*, September 30, 2001, p. 18.

[68] *Ibid*., p. 34.

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[69] *Ibid*., p. 42.
[70] *Ibid*., p. 42.
[71] *Ibid*., pp. 42-47.
[72] Jumper, General John P., remarks at the 2nd Annual Air and Space Conference, Washington DC, 6 March 2002.
[73] Mufson, Steven and Sharon LaFraniere, *The Washington Post*, "ABM Withdrawal A Turning Point In Arms Control," December 13, 2001, p. A1.
[74] Missile Defense Agency, *The Ballistic Missile Defense System*.
[75] Kadish Lieutenant General Ronald T., "The Missile Defense Program," FY 03 Budget Hearings, available online at http://www.acq.osd.mil/bmdo/bmdolink/pdf/budget03.pdf, 14 March 2002
[76] Sen, Philip and Richard Scott, "Pentagon cancels Navy Area TBMD," *Signals*, Jane's Navy International, March 1, 2002, available on-line at www.janes.com, posted 12 February 2002.
[77] Missile Defense Agency MDA Link, *Boost Defense Segment*, available at http://www.acq.osd.mil/bmdo/bmdolink/html/boost.html, 13 March 2002. Also see Keeter, "Service Officials: Navy Terminal-Phase Missile Defense Remains a Requirement."
[78] Towell, Pat, "Bush's Missile Defense Plan Harks Back to Father's 'Layered' Approach," *Congressional Quarterly Weekly*, 16 March 2002, p. 718.
[79] To reflect the Bush Administration's layered missile defense approach, JTAMDO changed its title from Joint Theater Air and Missile Defense Office to Joint Air and Missile Defense Office, but it retained the same acronym.
[80] Donnelly, John M., "Pentagon to Triple Money for Joint Staff Antimissile Office," *Defense Week*, 18 March 2002, p. 3. According to Mr. Donnelly, JTADO reportedly received $21 and $27 million in the previous two years, respectively, but in 1999, it received a huge one-time funding boost, a $92.5 million increase.
[81] Aldridge, E. C., Jr., Memorandum on Ballistic Missile Defense Program Implementation Guidance, 13 February 2002, summarized in unpublished JTAMDO briefing, "Evolving JTAMDO Role in Air and Missile Defense," 17 April 2002.

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[82] Lesser, Ian O., and Tellis, Ashley J., *Strategic Exposure: Proliferation Around the Mediterranean,* The RAND Corporation, Santa Monica, CA, June 1996, p. x.

[83] *Ibid*., pp. x, 27, 32.

[84] *Ballistic Missile Proliferation Challenges—2001*, Missile Defense Agency, Washington DC, available on line at http:/www.acq/osd.mil/bmdo/bmdolink/pdf/bm2001.pdf, 13 March 2001 Many of these countries also possess shorter range tactical missiles, such as the Frog, which also pose a theater missile threat.

[85] Lieutenant General Richard C. Bethurem, author interview, February 23, 1998.

[86] Joint Requirements Oversight Council, *Theater Missile Defense Mission Need Statement*, Washington, D.C., JROCM-064-91, approved on November 18, 1991. Furthermore, the objectives of TMD include preventing launch of theater missiles against U.S. forces, U.S. allies, and other important countries including areas of vital interest; protecting U.S. forces, U.S. allies, other important countries, and areas of vital interest form theater missiles launched against them; reducing the probability of and to minimize the effects of damage caused by theater missile attack; and detecting and targeting theater missile platforms, to detect, warn and report of theater missile launch, and to coordinate a multifaceted response to a theater missile attack and to integrate it with other combat operations.

[87] Joint Requirements Oversight Council, *Theater Missile Defense Mission Need Statement*, Washington, D.C., JROCM-064-91, approved on November 18, 1991, p. 5. Potential material alternatives and key boundary conditions were discussed further in the Mission Need Statement, which noted that, "TMD will require a balance of integrated attack operations, comprehensive active defense against missiles in flight, extensive passive measures, and a robust C3I and surveillance capability responsive to unique TM characteristics."

[88] Jeremiah, David E., Vice Chairman Joint Chiefs of Staff, Chairman JROC, and Gold, Theodore, JROC Co-Chairmen, *Memorandum for Chairman, Defense Science and Chairman, Defense Policy Boards*, undated.

[89] Bowie, Christopher J., *Destroying Mobile Ground Targets in an Anti-access Environment*, Analysis Center Papers, Northrop Grumman,

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December 2001, pp. 4-5. Many call this process, from identification, to tracking, to decision-making, to destroying a target, a "kill-chain."

[90] Joint Publication (JP) 3-01.5, *Doctrine of Joint Theater Missile Defense,* February 22, 1996.

[91] *FM 100-5, Operations*, June 1993, pp. 6-19 to 6-22, which observed that, "Defensive operations control the enemy's attack while preserving the defending force."

[92] *Air Force Doctrine Document 1 (AFDD-1)*, September 1997, p. 46.

[93] *Ibid*., p. 47.

[94] *Air and Space Conference* at Maxwell AFB, Alabama, November 19, 1997.

[95] Hawley, Major General John W., HQ ACC/DR, ACC/CC, *Combat Air Forces Concept of Operation for Command and Control against Time-Critical-Targets*, July 8, 1997, p. 6.

[96] ACC, *CAF CONOPS for Time-Critical-Targets*, p. 7. Italics included in the CONOPS.

[97] This study does not attempt to resolve all doctrinal concerns regarding the JFACC, however some suggestions are offered regarding missile defense.

[98] Ballistic Missile Defense Organization Fact Sheet 97-05, *Ballistic Missile Defense—The Core Programs*, September 1997. The Navy Area terminal defense missile was a core program cancelled December 2001. Portions of the program will be incorporated into existing and future ballistic missile defense programs.

[99] Undersecretary Peter Aldridge, OSD/PA Press Release, USD Aldridge Media Roundtable on Acquisition Program Updates, 22 March 2002. According to Mr. Aldridge: "So the Missile Defense Agency is going to write a single, selected acquisition report on the entire R&D program that they have under way. As you know, when we make a decision to deploy a system, such as we did for PAC-3, we will move it out of the Missile Defense Agency and give it to a service for the actual production and deployment and operation. And so the Missile Defense Agency has no deployment program. It is all R&D."

[100] The Missile Defense Agency refers to the systems they manage that would provide defense against missiles during the terminal phase as the "Terminal Defense Segment." BMDO previously discussed most of

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these systems as lower tier systems (the Theater High Altitude Area Defense system is considered to be an upper tier).

[101] Cohen, William S., *Annual Report to the President and Congress,* Government Printing Office, Washington D.C., 1998, p. 64.

[102] "Patriot Advanced Capability-3 System Flight Test Program," Ballistic Missile Defense Office Fact Sheet, November 2000, available at: http://www.acq.osd.mil/bmdo/bmdolink/pdf/aq9909.pdf as of 12 December 2001.

[103] Missile Defense Agency MDA Link, "Patriot Advanced Capability-3," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/html, 14 March 2002.

[104] Lyles, Lieutenant General Lester L., Director, Ballistic Missile Defense Organization, "Opening Remarks," *Congressional Testimony before the Subcommittee on Strategic Forces Committee on Armed Services*, U.S. Senate, March 24, 1998.

[105] Cohen, *Annual Report to the President and Congress,* p. 64.

[106] Ballistic Missile Defense Organization, *Theater Missile Defense Program Medium Extended Air Defense System (MEADS)*, available on line at http://www.acq.osd.mil/Ballistic Missile Defense Organization /bmdolink/html/meads.html, January 12, 1998.

[107] Missile Defense Agency, Fact Sheet, "Medium Extended Air Defense System," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/pdf/meads.pdf, 14 March 2002.

[108] Kadish Lieutenant General Ronald T., "The Missile Defense Program," FY 03 Budget Hearings, available online at http://www.acq.osd.mil/bmdo/bmdolink/pdf/budget03.pdf, 14 March 2002. p. 16.

[109] Cohen *Annual Report to the President and Congress,* p. 65.

[110] Ballistic Missile Defense Organization, Fact Sheet 97-08, *ARROW Deployability Program*, July 1997.

[111] See "For the Record," *Washington Post*, November 30, 1998, p. A20, for statements compiled from multiple news services.

[112] Missile Defense Agency, MDALink, *Terminal Defense Segment*, available at http://www.acq.osd.mil/bmdo/bmdolink/html/terminal.html, 14 March 2002.

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[113] Missile Defense Agency, Fact Sheet, "Theater High Altitude Area Defense (THAAD)," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/pdf/thaad.pdf, 14 March 2002.

[114] Ballistic Missile Defense Organization, Fact Sheet 204-00-01, November 2000, available on-line, http://www.acq.osd.mil/bmdo/bmdolink/pdf/acq9905.pdf as of December 13, 2001. Also, Missile Defense Agency, Fact Sheet, "Theater High Altitude Area Defense (THAAD)."

[115] Ballistic Missile Defense Organization, Web, *Theater Missile Defense Program Theater High Altitude Area Defense*, available on line at http://www.acq.osd.mil/Ballistic Missile Defense Organization /bmdolink/html/thaad.html, January 12, 1998.

[116] Cohen, William S., *Annual Report to the President and Congress,* p. 64, and Graham, Bradley, "Navy Will Get A Shot At Missile Defense," *Washington Post*, November 30, 1998, p. A1. "With the Army's $14 billion effort faltering badly amid a host of quality control problems and five consecutive test intercept failures, the Navy program has emerged in the eyes of many missile defense advocates as the nation's best hope for fielding an effective medium-range antimissile system." As a result of these test failures, the GAO recommended in 1998 that initial production be delayed until independent testing confirmed the system could met its key performance requirements. DoD disagreed with the report, and development continues. Yet, the Navy Area program was cancelled in December 2001. General Accounting Office, Report to the Secretary of Defense, *Ballistic Missile Defense—Improvements Needed in THAAD Acquisition Planning* GAO/NSIAD-97-188, Washington, D.C., September 1997, p. 7. The GAO recommended that the BMDO delay initial production of the THAAD until independent testing in an operational environment confirmed, "that the system can meet its key performance requirements. Since the Department of Defense disagreed with the GAO's recommendation, this report also contains the Department of Defense response to the GAO.

[117] Kadish, "The Missile Defense Program," p. 15.

[118] Missile Defense Agency, Fact Sheet, "THAAD Testing Program," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/pdf/thaadtes.pdf, 14 March 2002.

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[119] Kadish, "The Missile Defense Program," pp. 15-16. Also see Keeter, "Service Officials: Navy Terminal-Phase Missile Defense remains a Requirements," and Sen, "Pentagon cancels Navy Area TBMD."

[120] Ballistic Missile Defense Organization, Fact Sheet 97-18, *Navy Area Ballistic Missile Defense Program*, July 1997.

[121] Snyder, Robert, "Ballistic Missile Defense Organization Press Release: FY01 President's Budget," Ballistic Missile Defense Organization, Washington D.C., February 4, 2000. Available on-line at: http://www.acq.osd.mil/bmdo/bmdolink/pdf/bmdopress.pdf as of December 12, 2001.

[122] Missile Defense Agency, Midcourse Defense Segment, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/html/midcrse.html, 13 March 2002.

[123] Missile Defense Agency, Fact Sheet, "Sea-based Midcourse," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/pdf/seabased.pdf, 13 March 2002.

[124] Ballistic Missile Defense Organization, Fact Sheet 97-19, *Navy Theater Wide Ballistic Missile Defense Program*, October 1997. The SM-3 is the Standard Missile 3; the Navy Area program also builds on the Standard Missile system.

[125] Timing for operational capability initially taken from the National Institute of Public Policy frequently asked questions web site at: http://www.nipp.org/Adobe/laymans%20guide%20adobe/No.%2013.pdf, as of 13 December 2001. These times were further revised as of January 2002. See MDA Fact Sheet, "Sea-based Midcourse."

[126] The Missile Defense Agency refers to the systems they manage that would provide defense against missiles during the boost phase as the "Boost Defense Segment" (BDS). The Missile Defense Agency lists four objectives for the BDS: 1) demonstrate and deploy the Airborne Laser, 2) define and evolve space-based and sea-based kinetic energy Boost Phase Intercept (BPI) concepts with a development decision in 2003-2005, 3) execute a "proof-of-concept Space-Based Interceptor Experiment," 4and 4) continue Space-Based Laser for a proof-of-concept in 2012. See Missile Defense Agency, MDALink, *Boost Defense Segment*, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/html/boost.html, 14 March 2002.

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[127] Missile Defense Agency, Fact Sheet, *Airborne Laser*, January 2002. It should be noted, however, that the Airborne Laser program office estimates initial operational capability two years earlier, in 2007, with full operational capability in 2009. Further, after the demonstrations in 2004, residual operational capability will be left behind, enabling the deployment of the test bed for operational purposes, if required. See the Airborne Laser program homepage at http://www.airbornelaser.com as of March 21, 2002

[128] Cohen, *Annual Report to the President and Congress,* p. 64.

[129] To "fractionate" is sometimes used to describe multiple re-entries, which are divided or split into multiple pieces in order to complicate matters for the defender.

[130] Fogleman, General Ronald R., "The Air Force Role in Theater Ballistic Missile Defense," remarks delivered to the American Defense Preparedness Association/National University Foundation Breakfast Seminar Series on Missile Defense, Counter Proliferation, and Arms Control, Washington, D.C., June 16, 1995

[131] *1997 United States Air Force Issues Book*, Airborne Laser, available on line at http://www.af.mil/lib/afissues/1997/app_b_14.html.

[132] *1997 United States Air Force Issues Book*, Airborne Laser, available on line at http://www.af.mil/lib/afissues/1997/app_b_7.html.

[133] Missile Defense Agency, Fact Sheet, "Space Based Laser (SBL)," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/pdf/sbl.pdf, 13 March 2002.

[134] Missile Defense Agency, MDALink, *Boost Defense Segment*, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/html/boost.html, 14 March 2002.

[135] Missile Defense Agency, fact Sheet, "Kinetic Energy," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/pdf/kinetic.pdf, 13 March, 2002.

[136] XORFS, "USAF Roadmap for Theater Missile Defense attack operations," Archived Briefing at XORFS, presented July 27, 1997 (unclassified extract dated February 5, 1998). For further information, please consult the Counterair (Theater Missile Defense) Mission Area Plan, FY 1996, November 15, 1995. Obviously, attack operations would

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be important for suppression and destruction of intercontinental ballistic and other missiles.

[137] JAOWG, "Integrated Investment Strategy," Draft Briefing, February 5, 1998. This breakdown provides some understanding of the level of integration that is necessary to conduct attack operations on a planned basis; budget information also is contained in detail in this briefing.

[138] Butz, Major Brad, AF XORFX and SAF AQPT, "USAF Attack Operations," briefing for Lieutenant General Lyles, February 9, 1998.

[139] Deptula, Major General David A., *Effects-Based Operations: Change in the Nature of Warfare* (Arlington, Virginia: Aerospace Education Foundation), p 11-18.

[140] Although Air Force units from AFSOC, Air Force Special Operations Command, engage in special operations, SOF is not discussed in depth in this paper. Nevertheless, SOF definitely provides attack operations capabilities, both in conjunction with direct conventional aerospace power attacks and as an additional intelligence-gathering source.

[141] Cohen, *Annual Report to the President and Congress,* pp. 64-5.

[142] Ballistic Missile Defense Organization, Web, *Joint Theater Missile Defense Programs—BM/C3I*, available on line at http://www.acq.osd.mil/Ballistic Missile Defense Organization /bmdolink/html/tmdccc.html, January 12, 1998.

[143] Scott, William B., "Scud Missile Warning Time Cut to Seconds," *Aviation Week & Space Technology*, February 23, 1998, p. 108. The 11th SWS is part of the 21st Space Wing, Falcon AFB, Colorado.

[144] Fogleman, General Ronald R., "The Air Force Role in Theater Ballistic Missile Defense," remarks delivered to the American Defense Preparedness Association/National University Foundation Breakfast Seminar Series on Missile Defense, Counter Proliferation, and Arms Control, Washington, D.C., June 16, 1995." See also "USAF Roadmap for Theater Missile Defense Attack Operations."

[145] Air Combat Command, *CAF CONOPS for Time-Critical-Targets*, pp. 1, 19-22.

[146] Missile Defense Agency, *The Ballistic Missile Defense System*.

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[147] Missile Defense Agency, fact Sheet, "Sensors," January 2002, available on-line at http://www.acq.osd.mil/bmdo/bmdolink/pdf/sensors.pdf, 14 March 2002.

[148] Joint Publication (JP) 3-01.5, *Doctrine of Joint Theater Missile Defense,* February 22, 1996.

[149] Joint Publication 3-01.5, *Doctrine of Joint Theater Missile Defense,* February 22, 1996, p. III-1.

[150] Towell, "Bush's Missile Defense Plan," p. 718. ""Nearly $2 billion of the fiscal 2003 request is for systems designed to protect relatively small areas by striking enemy warheads in the 'terminal' phase of flight – as they near their targets…all the systems currently funded are designed to deal with shorter range – and slower – missiles, such as the Scuds."

[151] BMC4I also provides warning for passive defense measures and point defense through the PAC-2 or 3.

[152] This is based on amount of ground covered versus price of coverage. The new Patriot PAC-3 is a multi-billion dollar system that protects only a limited geographic area. This does not imply, however, that point systems are not prudent. Yet, they are relatively expensive.

[153] Information that is acquired through a Defense Support Program (DSP) satellite, overhead asset, UAV, E-8 JSTARS, among other platforms, can use C2 links to provide rerouting information.

[154] See Hewish, Mark and Janssen Lok, Joris, "Stopping the Scud Threat: Engaging Theater Ballistic Missiles on the Ground," *Jane's International Defense Review*, June 1997, pp. 40-47, for an overview of joint systems used in attack operations, including many BMC4I systems.

[155] JTAMDO briefing, "Evolving JTAMDO Role in Air and Missile Defense," 17 April 2002. JTAMDO has produced many studies, reports, and tests to assist in integration of joint missile capabilities, including: the 2010 Operational Concept; Theater and Air Missile Defense Master Plan; Cruise Missile Defense technology Transition; Theater Missile Defense Capstone Requirements Document; Cruise Missile Defense Roadmap; Cruise Missile Defense Demonstrations; Joint Mission Area Analysis; Theater Air and Missile Defense Mission Need Statement; Theater Air and Missile Defense Capstone Requirements Document; Combat Identification Capstone requirements Document; TAMD Operational Architecture;

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Single Integrated Air Picture Systems Engineer; and the Joint Distributed Engineering Plant.

[156] *J-8, Battle Management Concept for Joint Theater Air and Missile Defense Operations, Final Draft*, September 1997, pp. VI-12. "The rapid development of systems command and control systems will enable the warfighter to efficiently divert aircraft when it is necessary to attack time-critical-targets. These systems will also give the battle manager the means to coordinate with the surface component command and control nodes for surface fires on time-critical-targets. Thus, by 2003, the there be four general procedures to combat the time-critical-targets problem: diverting airborne assets; using airborne combat air patrol assets; coordinating for surface fires on the target; and tracking the time-critical-targets to its hide site or resupply point." JTAMDO is currently producing updated concepts of operations covering a variety of air and missile defense situations.

[157] *Ibid*., p. V-13. There are many procedures and techniques for integrating land defense and air offensive forces, such as wounded-bird procedures, radio-out procedures, and identification friend or foe (IFF) procedures, among others. While there are limitations with IFF targeting practices, this document encourages broad integration of joint TMD concepts under the control of an operation's JFACC.

[158] The USAF has ten Air Expeditionary Forces (AEFs), each with approximately 120 aircraft of various types and capabilities. These AEFs rotate deployment duties for contingency operations and training so that two AEFs are immediately available, trained, and ready for duty at all times. Aircraft in the scheduled AEF not deployed in support of contingency operations are available for rapid deployment, if required. The eight AEFs not on status during a given period conduct training and exercises in preparation for their scheduled time availability window time. The USAF also maintains two Air Expeditionary Wings (AEWs), one "on-call" at all times, for rapid deployment to crisis situations. The AEW is several dozen aircraft of fewer types; it is a smaller unit than an AEF, organized to provide multiple capabilities in response to crises. In event of war, the AEF schedule dissolves and the units flow to participate in existing warplans.

[159] Lesser Tellis, *Strategic Exposure: Proliferation Around the Mediterranean,* p. 27. As noted in the Army sponsored RAND study,

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Strategic Exposure, "In near-term crises, southern European countries will almost certainly require deployment of ATBM and air defense assets on or around their territory (regardless of the effectiveness) in order to reassure parliaments and publics. Over the longer term, development and deployment of truly effective ATBM defenses—perhaps sea based and capable of deployment around the Mediterranean—may be a prerequisite for NATO engagement outside Europe."

[160] Ballistic Missile Defense Organization, Fact Sheet 97-05, *Ballistic Missile Defense—The Core Programs*, September 1997.

[161] Air Land Sea Application Center, JTMTD Multi Service Procedures for Joint Threat Missile Target Development, approved October 1999; Air Combat Command, Concept of Operations for Command and Control in Cruise missile Defense, Draft, August 1996; the ACC, CAF CONOPS for Time-Critical-Targets; and the J-8, BM Concept for Joint Theater Air and Missile Defense Operations, all are examples of approaches toward facilitating and integrating CONOPS, as well as the emerging JTAMDO Integrated Missile Defense CONOPS.

[162] The AEW Battlelab at Mountain Home AFB, Idaho, could address the organizational issues and configuration decisions facing attack operations missions in order to refine this concept.

[163] There may be an overlap for equipment with multiple functions, but attack operations can proceed without new equipment. However, this would involve relying on older methodology, such as retasking via secure radio or "in the clear" with code words, to remain effective. With current USAF attack operations and BMC4I capabilities and near-term improvements, a credible attack operations force is possible using the capabilities resident today in operational units and combined air operations centers.

[164] According to the *Air Force Doctrine Document 1*, published in September 1997, pp. 46-47, anti-missile attack operations may be more like SEAD than DCA. As noted in the XORFS attack operations roadmap: "Because air and space forces are inherently offensive and yield the best effect when so employed, OCA is often the most effective and efficient method for achieving the appropriate degree of air superiority. This function consists of operations to destroy, neutralize, *disrupt or limit enemy air and missile power as close to its source as possible and at a*

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time and place of our choosing…The attack aircraft and missile threat may include fixed- and rotary-wing attack aircraft, reconnaissance aircraft, unmanned aerial vehicles, air-, land-, and sea-launched *cruise missiles, ballistic missiles*, and air-to-surface missiles." General Fogleman noted that attack operations are offensive because, "Pre-emptive precision strikes against point targets and application of denial weapons will greatly hinder near-term enemy TBM activity. Meanwhile, lethal precision attacks against the TBM support tail will undercut the enemy's ability to sustain long-term ballistic missile operations…if the enemy succeeds in launching a mobile TBM, detection of the launch event will key our attack operations. We will capitalize on the inputs from overhead and surface sensors, special operations forces, JSTARS, AWACS, Rivet Joint aircraft, U-2s and unmanned aerial vehicles—UAVs. Those inputs will identify the launch point and cue Air Force and other service assets for time-critical strikes on the enemy TEL." See Fogleman, General Ronald R., "The Air Force Role in Theater Ballistic Missile Defense."

[165] JP 3-01.5, p. XI. "The joint force air component commander (JFACC) plans for the theater / joint operations area-wide attack operations effort. The JFACC is also responsible for executing attack operations outside other components' areas of operations (AOs). Component commanders are normally designated as supported commanders for attack operations inside their AOs…The JFC will normally assign responsibility for the planning and execution of JTMD attack operations outside the other component commanders areas of operations (AOs) to the JFACC. Since the location of these AOs may change with the maneuver of forces or with changes in JFC guidance, the JFACC should also plan for and maintain visibility on the theater/joint operations area (JOA)-wide attack operations effort. This will ensure the JFACC is prepared to support the other component commanders when, for example, they request JFACC support in conducting JTMD attack operations within their AOs. Inside their AOs, component commanders are normally designated as supported commanders for attack operations."

[166] Krepenevich, Andrew F., Executive Director, Center for Strategic and Budgetary Assessments, author interview, February 11, 1998, who noted that there is an unresolved program-budget mismatch in the 1997 Quadrennial Defense Review (QDR).

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